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By

IRA D. CLARKE

Chemist

and

J. S. ROGERS

Head

Hides, Tanning Materials, and Leather Division

Eastern Regional Research Laboratory

Bureau of Agricultural and Industrial Chemistry

A. F. SIEVERS

Biochemist

Division of Tobacco, Medicinal, and Special Crops

Bureau of Plant Industry, Soils and Agricultural Engineering

Agricultural Research Administration

and

HENRY HOPP

Soil Conservationist

Erosion Control Practices Division

Soil Conservation Service Research

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By Ira D. Clarke, *chemist*, and J. S. Rogers, *head, Hides, Tanning Materials, and Leather Division, Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry;* A. F. Sievers, *biochemist, Division of Tobacco, Medicinal and Special Crops, Bureau of Plant Industry, Soils and Agricultural Engineering; Agricultural Research Administration;* and Henry Hopp, *soil conservationist, Erosion Control Practices Division, Soil Conservation Service Research* [2]

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INTRODUCTION

The domestic supply of vegetable tannins for many years has fallen far short of the needs of the leather industry. Before World War II, about 60 percent of the tannin used in the United States was imported. During the war, the shortage of tannin became acute, and after the war there was considerable uncertainty concerning prices and deliveries of important foreign tannins such as quebracho. The supply of chestnut wood, the present most-important source of domestic tannin, is continuously decreasing as a result of the blight. New or undeveloped sources of domestic tannin are needed to relieve this country's dependence on foreign tannin.

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Sumac, a well-known native tanning and dyeing material, might be used advantageously to meet part of this demand: Although not suited for heavy-leather tannage, its use in the tanning of light-weight leathers could be largely expanded.

Sumac is used for tanning either in the form of the ground leaf or as an extract. Tanners of light-weight leather value sumac highly because it produces soft, durable, light-colored leathers. Tanners of medium-weight leathers use it for retanning because it lightens the dark color produced by some tanning materials and produces a uniform and desirable feel.

Sumac has attracted attention in the United States in recent years not only because of the ever-diminishing supply of raw tanning materials and the need for domestic replacements, but also because of the demand for plants that prevent soil erosion. Sumac has a shallow, spreading root system, which aids in holding soil (*5*) [3], and it is capable of growing on poor, eroded soils. In the last 10 years, the Soil Conservation Service has used sumac, particularly dwarf sumac (*Rhus copallina* L.), white or smooth sumac (*R. glabra* L.), and staghorn sumac (*R. typhina* Torn.), for erosion-control plantings in the Eastern States. These species have proved especially successful for checking erosion in the heads of gullies. Owing to its erosion-control value, wide adaptability, and ease of propagation, sumac would be a good crop for land that is too easily eroded to grow other crops.

Sumac plantings have value also as protection for wildlife, on account of the cover and food they provide (*23*).

Much of the sumac now used commercially originates in Sicily, where one species, *Rhus coriaria* L., has been grown under cultivation for hundreds of years and is so handled as to produce a material of high quality. A domestic product, usually known in the trade as American or Virginia sumac, has also been marketed for many years, but it is of poor quality in comparison with the imported product. The principal source of American sumac is Virginia; smaller amounts come from Maryland, West Virginia, and possibly one or two neighboring States. Accurate data on the source and amount marketed, however, are not available. Figures obtained directly from sumac dealers indicate that they purchased more than 640 tons of domestic sumac in 1933. According to data furnished by five leading manufacturers of tanning extract, the amount of domestic sumac used for the manufacture of extract from 1937 to 1944 averaged about 1,108 short tons a year.

After importation of Sicilian sumac was stopped by the war in 1941, an effort was made to increase collection of American sumac, but without much success. During the last 4 or 5 years, commercial collection of white or smooth sumac, *Rhus glabra*, has been started in Iowa, but it is still in the experimental stage. The reason for the low collection appears to be economic. The market price is high, as compared with that of other tanning materials, yet it is too low to yield an adequate return to labor. Collecting is now done principally by farmers during their spare time or by older persons and children as part-time employment.

Mechanical handling and other means for improving the quality

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[3] Italic numbers in parentheses refer to Literature Cited, p. 43.

and lowering the cost of sumac are being studied. Although some data are available from previous work, additional information is needed on the following points: (1) Tannin content and quality; (2) distribution and abundance; (3) habit of growth and leaf characteristics; (4) ease of collection; and (5) tanning properties.

To provide some of the information needed for determining the commercial value of the different species, a study was made of the sumac in 18 Eastern and Southern States. Although there was no opportunity to obtain samples throughout the area where the species grow, especially those that grow over a wide range, sufficient samples were collected to furnish the information required. This evaluation of sumac concerns primarily its tannin content. Many other qualities, such as the ability to impart weight, flexibility, softness, or other desirable properties to leather, must ultimately be considered in using the sumac commercially for tanning.

REVIEW OF LITERATURE

The usefulness of native sumac as a source of tannin has long been recognized. As early as 1869, the qualities of some of the American species, as compared with those of the Sicilian, were discussed in the Report of the United States Commissioner of Agriculture (*21, pp. 65–66; 230–232, 421*). It is stated that the tannin contents of sumac from Girardstown, W. Va., Fredericksburg, Va., and the District of Columbia range from 18.25 to 28.20 percent. The species are not given. In the same report, the possibilities of domestic sumac are discussed in considerable detail. *Rhus copallina*, *R. glabra*, and *R. typhina*, together with four less important species, are reported as having commercial value. It is claimed that domestic sumac is inferior to Sicilian sumac only in that it does not produce a white leather. Some facts concerning cultivation of sumac in Sicily are given, and a mill for grinding sumac is described. The domestic cultivation of sumac to meet the demand for it in the dyeing and tanning industries is predicted. The method of preparing sumac for market in Rhode Island is also described. The young growth, cut before the leaves have turned, is dried in the sun, protected from dew and rain, which injure it.

The collection of sumac appears to have been confined largely to the States along the eastern coast line, but in the Report of the United States Commissioner of Agriculture for 1872 (*22, p. 499*), attention is called to the shipment to England of 12,000 pounds of sumac from Missouri.

In the Report of the United States Commissioner of Agriculture for 1877, the chemist, William McMurtrie (*13*), reviewed the results of an investigation of American sumac. It was found that samples of *Rhus glabra* from Georgetown, D. C., and Winchester, Va., contained 16.50 and 23.56 percent of tannin, respectively; a sample of *R. typhina* from Georgetown contained 16.18 percent; and one of *R. copallina* from Winchester, 16.99 percent. The difference in market value of Sicilian and American sumac was reported to be due to the yellow coloring matter in the latter. To overcome this, it was suggested that the sumac be collected in June, although the tannin content is greater in July. It was also suggested that the collections made in

June be used for tanning delicately colored leathers and that the July collections be used for tanning dark-colored leather and dyeing dark-colored goods.

McMurtrie (*14*) in 1880 reviewed the general information then available concerning the species of sumac of value for tanning, both in Europe and the United States, including soil requirements, and methods of propagating, harvesting, drying, and preparing for market. To assure maximum quality of the domestic article, he recommended that the leaves be collected when in full sap, before they have turned red, or have been affected by frost. He stated that the leaves may be allowed to wither on the stalk before being carried to the drying shed, that they must not be scorched or bleached by the sun, and that at least 1 month is required to dry the product enough to market it.

Kalteyer (*12*) in 1892 reported an investigation of Texas sumac begun in 1873 to determine yields, the most favorable time for collection, and the percentage of tannin in the leaves, stems, berries, roots, and root bark; to devise methods of preparation for market; and to compare its quality with that of sumac from other places. *Rhus copallina* was the most abundant in the State and much taller than in the Northern States. Its tannin content was higher than that of any other species examined except the best Sicilian. The average tannin contents of three samples of Texas sumac and three of Virginia sumac were reported to be 21.94 and 20.76 percent, respectively. Kalteyer proposed cutting the young branches, letting them lie on the ground for 1 or 2 hours, drying with heat at about 80° C., and then threshing them well to remove the leaves, which were later to be ground and bagged. Other species growing in the State were *R. microphylla* Engelm., *R. trilobata* Nutt., and *R. virens* Lindh. ex A. Gray.

In 1900 Peacock (*15*) published a summary of the results of an investigation of tannin plants by Trimble. Analyses were reported of the leaves, berries, flowers, and bark from the roots and stems of a number of plants of several species of sumac collected near Philadelphia, Pa. Data on the source, date of collection, degree of red color in the leaves, and other related conditions were included. The minimum and maximum percentages of tannin in the leaves of three species were as follows: *Rhus copallina*, 17.74 and 42.51; *R. glabra*, 13.83 and 40.52; *R. typhina*, 17.41 and 28.64. The highest percentage in each species was found in July.

Stockberger (*20*) in 1910 emphasized the possibility of growing *Rhus glabra* and *R. copallina* under cultivation in the sections of this country in which they are collected in commercial quantities. He pointed out that the former contains from 15 to 25 percent tannin and the latter as high as 38 percent and that *R. copallina* from certain localities makes a lighter colored leather than the commercial Sicilian sumac. He suggested that this quality and high tannin content might perhaps be maintained in plants cultivated in favorable localities and a product of high value thus produced. He also called attention to the fact that the plant is easily cultivated and that a method of harvesting could be used similar to the one used abroad, where the branches are cut with a mowing machine and the leaves, when dry, are removed by threshing.

The wide variation in the quality of the leaves of the three species, *Rhus typhina*, *R. glabra*, and *R. copallina*, in Virginia and West Virginia was shown in 1910 by Delaney (*10*), who reported the analyses of 20 samples. Five samples of leaves and four samples of stems of *R. glabra* contained from 10.1 to 35.7 and from 4.0 to 9.5 percent of tannin, respectively. Two samples of leaves and stems combined contained 18.6 and 26.3 percent, respectively. Two samples of leaves of *R. copallina* contained 31.5 and 31.7 percent; two samples of stems, 5.8 and 10.9 percent, and one sample of leaves and stems combined, 17.6 percent. The average tannin content of a number of leaf and stem samples of *R. typhina* from Virginia was 29.3 percent. In a sample from West Virginia, the leaf portion contained 11.9 percent of tannin, and the stem portion contained 4.7 percent. It is stated that the three species are often collected and mixed indiscriminately and that the buyer does not know what kind of sumac he is getting. The sole difference between domestic and foreign sumac, it is pointed out, is that the former contains more of the red coloring matter and hence is less satisfactory for making light-colored leather.

Veitch, Rogers, and Frey (*25*) in 1918 reported an investigation of American sumac, with particular reference to its commercial use. Subjects discussed are the kinds and quality of sumac desired by extract manufacturers, the proper time to gather it, the quantity that one person can gather in a day, loss in curing and handling, and prices obtained by collectors. Analyses of samples of the three most important species, namely, *Rhus copallina*, *R. glabra*, and *R. typhina* (which they call *R. hirta* L. Sudw.) led to the conclusion that the first mentioned, dwarf sumac, contains more tannin than the other two. They found that the stalks of this species contain from 5 to 10 percent of tannin, which, they point out, justifies the extraction of the stalks for the preparation of an extract for tanning when color is not a primary consideration. They cite the experience of extract makers that sumac from Virginia, West Virginia, North Carolina, and western Kentucky contains more tannin and yields more extract than that from States farther north. It is stated that lack of care and attention in gathering and curing the sumac is responsible for inferior quality and that heating and molding, undue exposure to the sun, or any exposure to dew or rain reduces the tannin content. To improve the quality of the sumac, it is suggested that buyers and collectors cooperate and that buyers pay for the sumac on the basis of quality.

The importance of sumac to the American tanner was discussed by Hoar (*11*) in a report published in 1923. He compared the tannin contents of the three domestic species used commercially, and pointed out that the leaves of the upper extremities of the stalks contain more tannin than those of the base and that increase in age of the plant is accompanied by a general reduction of tannin content. He suggested that sumac be collected in June to assure the least color effect on the leather tanned with it.

Russell (*16*) in 1943 reported an examination of 14 species of 6 genera of the sumac family found in the southeastern United States. He rejected all but 3, *Rhus copallina*, *R. glabra*, and *R. typhina*, as having no practical possibilities. Since small-scale tests indicated that *R. copallina* was definitely superior to *R. glabra* and *R. typhina*, additional work was limited to *R. copallina*. Full-scale tannery tests were then made, from which he concluded that properly prepared leaf material of domestic *R. copallina* could satisfactorily replace Sicilian sumac leaf both for retanning chrome skivers in the blue and for tanning pickled skivers; that *R. copallina* leaf gave firm, well-filled, near-white tannages on both pickled calf and goat leathers; that the darker shade of the domestic tannages could probably be avoided by stone milling the cured leaf to prevent contamination by traces of iron; that partial bleaching in the sun before final curing might improve the color; and that the slightly inferior plumping action of the domestic product was probably an inherent property of the tannin. He stated that differences between the domestic and Sicilian tannages could be detected only by an experienced tanner.

In a later test, reported in 1943, in which a mixture of leaves and stems of *Rhus copallina* containing 21 percent of tannin was used, Russell (*17*) found that tanning was unsatisfactory. This he ascribed to the large proportion of stems in the material and the low tannin content. He concluded that some process for improving quality similar to that used for Sicilian sumac would have to be applied to the domestic product.

Sievers and Clarke (*18*) in 1944 reported the results of several years' investigations on growing *Rhus copallina*, *R. glabra*, and *R. typhina* from seed and root cuttings and also the effect of cutting the plants on the yield and tannin content of the material harvested in subsequent years. The results were not conclusive, but the following trends were observed. The tannin content was higher in midseason than near the end of the growing season; plants grown from rootstock yielded more material of higher tannin content the first year than plants grown from seed, but the yield and quality were low in both cases; when plants were grown from seed, the tannin content of the leaves increased each year for at least 3 years; there appeared to be little relation between the tannin content and the total number of previous cuttings; two cuttings in a year were not advisable for 1- or 2-year-old plants because the second cutting did not yield enough to pay for the labor; in all cases the stems were so low in tannin content that their separation from the material greatly improved its quality. Evidence was obtained indicating that high tannin content is an inherited quality and that this may be the basis for developing more desirable types.

Boyd (*4*) in 1943 described a method of treating sumac seed with sulfuric acid to improve germination, and the following year he reported (*5*) a study of the root systems and the value of sumac for controlling erosion. In 1944 he also published another report (*6*), in which he stated that the tannin content of *Rhus aromatica* Ait. ranged from 15.0 to 26.3 percent, with an average of 21.2, that of *R. copallina* from 22.9 to 39.6 percent, with an average of 33.4, that of *R. glabra* from 15.2 to 34.9 percent, with an average of 26.6, and that of *R. typhina* from 14.8 to 33.0 percent, with an average of 24.2.

Barger and Aikman (*2*) in 1945 described methods and equipment for harvesting, drying, separating stems from leaves, and baling *Rhus glabra* in Iowa.

Clarke and Hopp (*8*) in 1945 published a study of the effect of method of drying on the composition of *Rhus copallina* leaves. They stated that "the data indicate that a desirable light-colored leather, generally comparable in this respect with that produced from Sicilian sumac, can be obtained if the leaves are dried rapidly either by spreading them out in the sun or in an oven with artificial heat. The production of undesirable dark-colored leather from dwarf sumac appears to be associated with decomposition products formed within the leaves during slow drying."

A commercial test designed to compare the relative values of Sicilian sumac and three species of domestic sumac for tanning sheepskin skivers was reported by Clarke, Mann, and Rogers (*9*) in 1946. They gave the order of decreasing preference expressed by the tanner as follows: *Rhus coriaria* (Sicilian); *R. copallina, R. typhina*, and *R. glabra*.

DESCRIPTION, DISTRIBUTION, AND ABUNDANCE OF THE SPECIES STUDIED

Several species of sumac are indigenous to the United States, but only three—*Rhus copallina, R. glabra*, and *R. typhina*—have been utilized commercially as a source of tannin, and *R. typhina* has never been used extensively. They are abundant in various areas in the eastern and central parts of the United States. They are well adapted to commercial utilization in that they are relatively leafy and yield much usable material and they frequently grow in large, dense stands, facilitating collection of the leaves and small branches. The season's growth can be broken or cut off rapidly, and the proportion of leaf in the material thus obtained is relatively high.

Besides these three species, five others that grow in the eastern half of the country were studied in this survey. These are *Rhus aromatica, R. lanceolata* (A. Gray) Britton, *R. microphylla, R. trilobata*, and *R. virens*. The first was collected only in Iowa, and the remainder only in Texas.

Table 1 shows the geographic distribution of each species studied and the approximate size of the plants and leaflets.[4] Figures 1 to 8 show the size and shape of leaves and leaflets of each species and distribution of the leaves on the stems.

It will be noted that the leaves of *Rhus aromatica* and *R. trilobata* have only three leaflets and that the leaflets of *R. trilobata* and *R. microphylla* are extremely small. *R. lanceolata* and *R. virens* also have relatively small leaflets. Because of the size of the leaves, commercial utilization of these species does not appear practical. The three species that have been utilized, namely, *R. copallina, R. glabra*, and *R. typhina*, are undoubtedly the best, and since they are also the most abundant and generally of satisfactory quality, their utilization is entirely logical.

The approximate range of each species in the area included in this survey is indicated in the small maps in figures 1 to 8, which are based on data by Barkley (*3*). No doubt the species are found occasionally outside the limits shown but not in any abundance, and there may be large areas within the indicated range where they do not occur

[4] Plants of the species of *Rhus* under consideration here have compound leaves with three or more leaflets. The leaflets vary in number and size according to the species and individuality of the plant (fig. 2).

TABLE 1.—*Distribution, size of plants, abundance of leaves, and number and size of leaflets of 8 species of sumac* (Rhus)

Species	Common name	Distribution [1]	Size of plant [1]	Abundance of leaves [1]	Leaflets [1]		
					Number per leaf	Length [2]	Width [2]
						Inches	*Inches*
R. aromatica Ait.	Aromatic sumac; Fragrant sumac	Quebec; south to Florida; west to Nebraska and Kansas.	Shrub (1.5 to 5 feet)	Numerous	3	1.4–1.8	0.7–1.4
R. copallina L.[3]	Dwarf sumac; Black sumac; Mountain sumac; Shining sumac	New Hampshire to Florida; west to Michigan, Missouri, and Texas.	Large shrub	do	7–27	.8–3.3	.3–1.1
R. glabra L.	White sumac; Smooth sumac	New Hampshire to Georgia; west to British Columbia, eastern Washington, Oregon, Nevada, and Mexico.	do	do	11–31	2.4–4.7	.6–1.2
R. lanceolata (A. Gray) Britton.	Plateau sumac	Oklahoma to Mexico	Small tree (33 feet)	do	13–19	1.2–2.2	.3– .5
R. microphylla Engelm.	Little leaf sumac	Western Texas to southeastern Arizona; south into Mexico.	Shrub or small tree (3.3 to 16 feet).	Sparse	5–9	.2– .4	.1– .2
R. trilobata Nutt.	Skunkbush; Illscented sumac	Iowa, Alberta, and California to south central Mexico.	Shrub (1 to 5 feet)	Fairly numerous	3	.4	.4
R. typhina Torn.	Staghorn sumac	Nova Scotia to North Carolina; west to Minnesota and Iowa.	Small tree	Numerous	9–27	2.4–5.1	.5–1.4
R. virens Lindh. ex A. Gray.	Evergreen sumac	South central Texas and southeastern New Mexico; south to Mexico.	Shrub	do	5–9	.5–1.6	.4– .8

[1] Compiled from Barkley (*3*).
[2] Does not include the terminal leaflet.
[3] Includes *R. copallina* L., var. *leucantha* (Jacq.) DC.

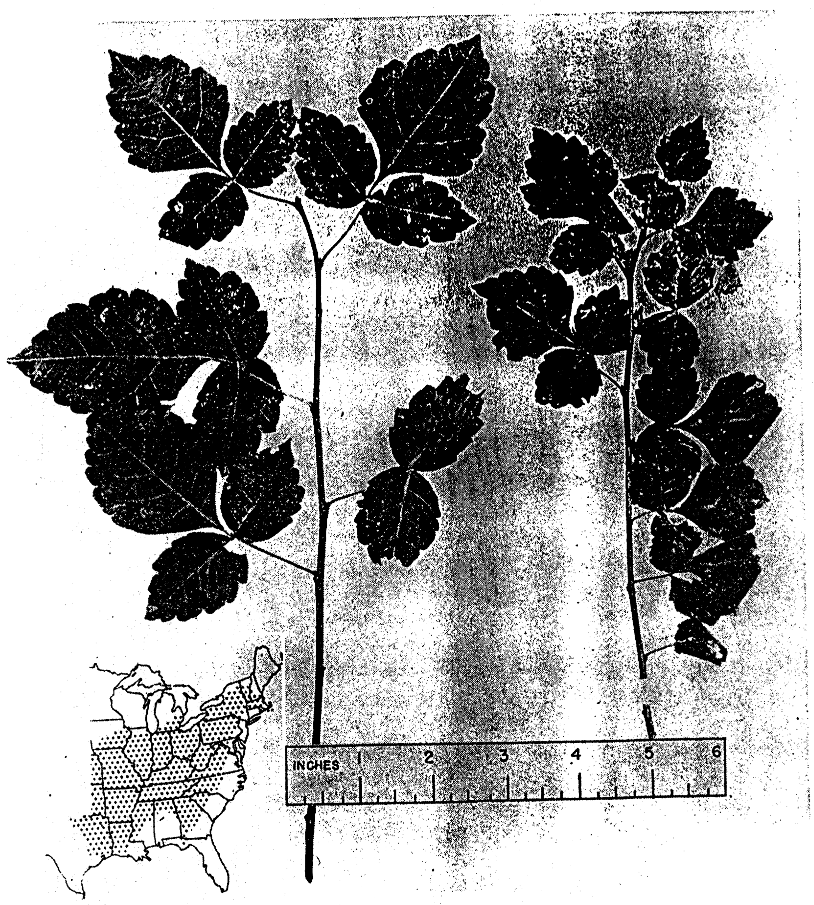

FIGURE 1.—Twigs of *Rhus aromatica* Ait.

at all. The extreme limits of the range of a species are of only minor significance in determining the areas where collections may be practical. Sporadic stands usually do not provide sufficient material to make collection worth while, but if other useful species are found in the same locality, gathering mixed material may be practical.

Figure 9 shows the areas of greatest abundance of the three species commercially important at present. These are much less extensive than the ranges indicated in the small maps mentioned. Even in these more restricted ranges, the species are by no means always found in sufficient abundance for profitable collection. The heavy, black lines define areas in the parts of the country covered by this survey in which the collection of these three species can most logically be recommended. Thus the area where the collection of *Rhus typhina* should be most practical is north of a line running along the southern boundaries of Lake Michigan, Lake Erie, and New York, and in a narrow area extending south along the Allegheny Mountains through West Virginia. *R. copallina* is most abundant through much of the

FIGURE 2.—Twig of *Rhus copallina* L. *a*, Stem; *b*, petiole; *c*, rachis (winged in this species but not in the others); *d*, lateral leaflet; *e*, terminal leaflet.

Coastal Plain, northern Florida, and the Gulf States. The northern limits of the range in which its collection is practical extends from southern New Jersey through central Virginia and North Carolina, then west to include most of Tennessee, and thence southwest through Arkansas and east Texas. *R. glabra* is found in sufficient abundance in numerous localities in the area extending from southern New England through the Middle Atlantic States and west to include the central Mississippi Valley. It is too scattered in the Plains States to make its collection there feasible..

Although each of the three areas shown in figure 9 is assigned to a different species of sumac, there are locations in each in which collectible quantities of another species are found.

The total quantity of wild sumac leaf available for commercial utilization has never been accurately estimated, but no doubt it far exceeds the present market demand. As was pointed out in the introduction, users rely mainly on foreign sources for their supply. The quantity actually available in this country, however, is of interest because of the need for new sources of tannin to augment the dwindling commercial supply.

In 1942, shortly after the entry of the United States into World War II, an immediate need arose for an increased amount of sumac leaf. A rapid survey was made at that time in southern Virginia to

FIGURE 3.—Twig of *Rhus glabra* L.

FIGURE 4.—Twigs of *Rhus lanceolata* (A. Gray) Britton.

determine the amount available there. A transect was laid out across the entire southern part of the State, from the Kentucky border to the Atlantic coast, in a band 31.6 miles wide along the North Carolina line (fig. 10). The transect was sampled along a center line by means of plots 1 square mile in area at intervals of 31.6 miles. For the 31.6-mile transect, this gave a coverage of 1:1,000. The plots were located on a large-scale base map before the survey was started. Aerial photographs of each plot (scale, 8 inches to a mile) were obtained, so that the boundaries could be readily identified in the field. All the open land, field borders, fence lines, hedgerows, roads, lanes, and woods borders on each plot were traversed to locate the sumac stands.

Forests were not surveyed, since the scattered sumac plants in forests cannot justifiably be considered as collectible. Scattered individual plants were not counted for the same reason. The stands of sumac were outlined directly on the aerial photograph, and notes were taken as to (1) species, (2) density per 100 square feet (in round numbers), (3) average height to the nearest foot, (4) character of stand, and (5) slope and other factors that might influence collectibility. The area of each stand was measured with a planimeter, and an estimate was made of the approximate number of plants present. The yields of leaves were calculated from a yield table [5] constructed

FIGURE 5.—Twigs of *Rhus microphylla* Engelm.

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[5] Based on unpublished collection data.

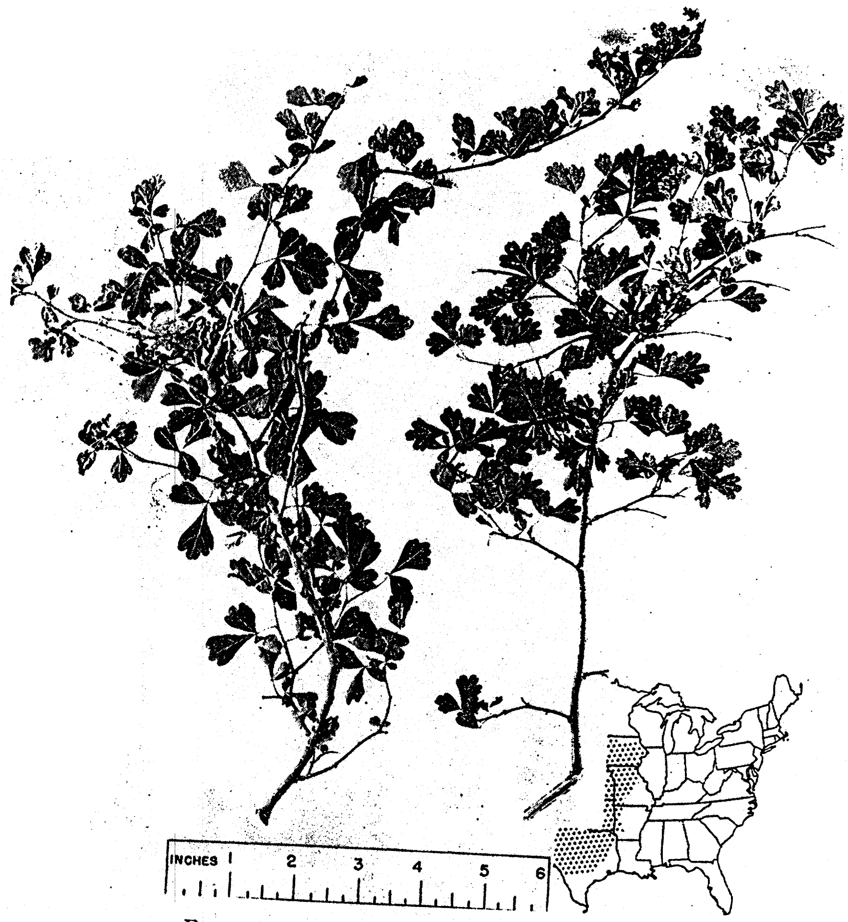

FIGURE 6.—Twigs of *Rhus trilobata* Nutt.

Figure 7.—Twig of *Rhus typhina* Torn.

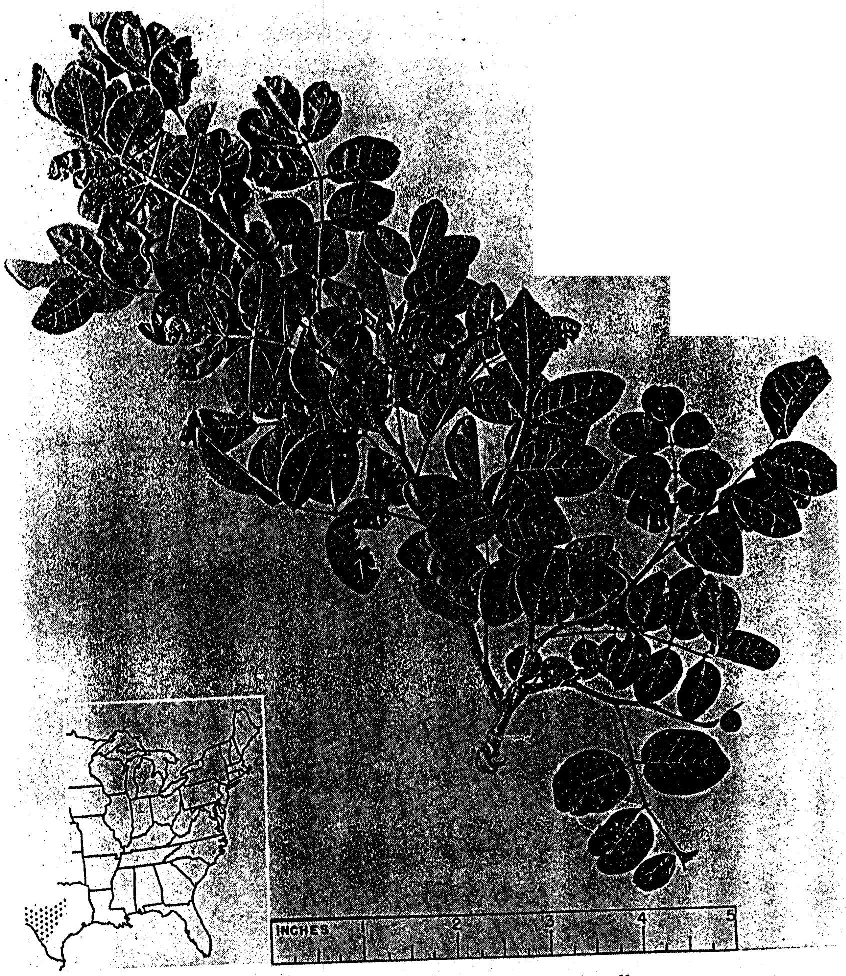

FIGURE 8.—Twig of *Rhus virens* Lindh.

to give the quantity of leaves obtainable per plant, according to size and type of growth.

The map in figure 10 shows the location of the sample plots in the area. The graph below the map shows the distribution of the species. A mixture of *Rhus glabra* and *R. copallina* occurred in the Cumberland Plateau area of western Virginia. The Blue Ridge area east of the Shenandoah Valley was characterized by *R. glabra* and smaller proportions of *R. typhina*, but *R. copallina* was practically absent. On the Piedmont Plateau there was a mixture of *R. copallina* and *R. glabra*, and in the Coastal Plain almost all the sumac was *R. copallina*.

Based on this distribution, the area was divisible into three belts, and the estimates were compiled separately for each, as shown in the lower part of figure 10. The western belt contained sufficient *Rhus copallina* and *R. glabra* combined to yield an estimated 6,000 long tons of air-dry sumac leaf annually; the central belt contained 28,000 long tons, consisting mainly of *R. glabra* and smaller proportions of *R. typhina* and *R. copallina*; the eastern belt contained 9,000 long tons, consisting almost entirely of *R. copallina*.

This survey, which is probably the only estimate of collectible sumac made by careful field measurements, indicated that this one area alone contained sufficient sumac to provide far more than the present annual national needs for sumac leaf.

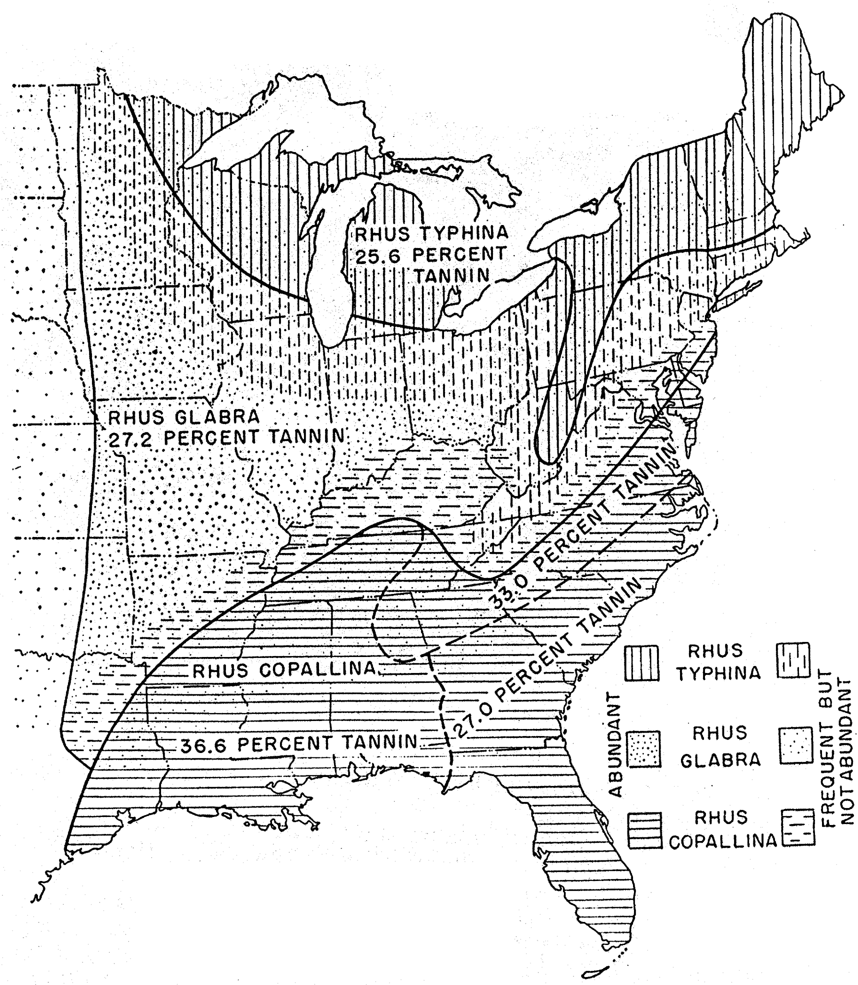

FIGURE 9.—Distribution, relative abundance, and average tannin contents of the 3 species of domestic sumac of greatest commercial interest.

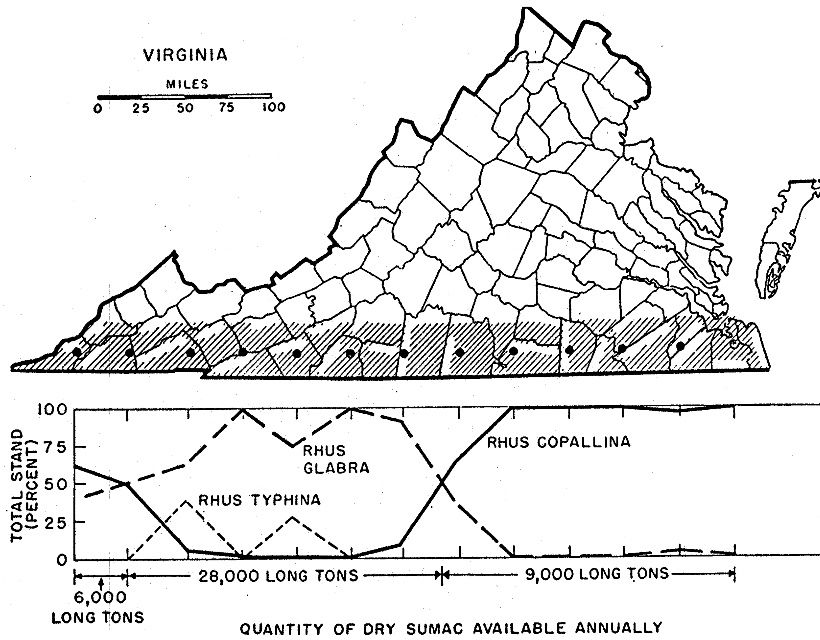

FIGURE 10.—Quantity of commercially collectible sumac leaf in southern Virginia in 1942. The shaded zone shows the area included in the survey. Locations of the 13 individual square-mile plots are indicated by dots. The chart below the map gives the proportions of the 3 commercially promising species in each of the plots. Estimates of collectible leaf, based on these proportions, are shown for each of the 3 major zones.

PROCEDURE AND METHODS

The samples of leaves for analysis were collected from wild plants from central New York, through Pennsylvania, New Jersey, Maryland, Virginia, and the southern Appalachians, west through Tennessee and the Gulf States to western Texas, and from a number of localities in Iowa. In most States, collections were made in only a few counties as opportunity permitted, but in southern New Jersey, Maryland, and Virginia, in the southern Appalachians, and in central Texas, the samples were well distributed. Appendix tables 13 to 18 show where the collections were made; table 2 is a summary by States showing how many collections were made of each species. The locations of the collection are indicated on a map in figure 16. Cultivated plants were growing in some of the locations, but no samples of them have been included here, as this survey is concerned only with wild plants.

In 17 localities in Virginia, Maryland, and West Virginia, the studies were made in considerable detail. Two collections of *Rhus copallina*, *R. glabra*, and *R. typhina* were made in each of two successive seasons from the same clumps or stands in these localities. Numerous samples of these three species and of *R. aromatica* were collected in Iowa, principally in the southeastern section of the State. The collections

TABLE 2.—*Number of localities from which samples of sumac* (Rhus) *were collected and number of samples taken*

Part of plant	Species	New York		Pennsylvania		New Jersey		Maryland		District of Columbia		West Virginia		Virginia		North Carolina		Kentucky	
		Localities	Samples	Localities	Samples	Localities	Samples	Localities	Samples	Localities	Samples	Localities	Samples	Localities	Samples	Localities	Samples	Localities	Samples
		Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Leaves	*R. aromatica*																		
	R. copallina			2	2	11	21	6	47					18	78	10	10	3	3
	R. glabra	4	6	15	25	2	2	17	51			2	5	17	51	6	6	3	3
	R. lanceolata																		
	R. microphylla																		
	R. trilobata																		
	R. typhina	6	8	14	18	1	1	8	16			1	4	5	15	1	1		
	R. virens																		
	Total		14		45		24		114		0		9		144		17		6
Leaflets and petioles [1]	*R. copallina*					6	14	1	2			1	2	1	1				
	R. glabra	1	1	1	21	2	4	5	14					1	2				
	R. typhina	1	1	1	14	1	2	1	1										
	Total		2		35		20		17		0		2		3		0		0
Stems	*R. aromatica*																		
	R. copallina			2	2	10	19	3	12	1	1			3	3	1	1		
	R. glabra			7	8			5	12					1	2				
	R. lanceolata																		
	R. trilobata																		
	R. typhina			5	10	1	1	4	7										
	Total		0		20		20		31		1		0		5		1		0
Bark and wood [2]	*R. copallina*					5	22	1	4										
	R. glabra			1	2			1	2										
	R. typhina			1	12	1	2	1	4										
	Total		0		14		24		10		0		0		0		0		0
Flowers and seed [3]	*R. copallina*					3	3	2	5					8	19				
	R. glabra			6	13			5	7										
	R. typhina			4	5			1	2										
	Total		0		18		3		14		0		0		19		0		0
	Grand total (18 States)		16		132		91		186		1		11		171		18		6

See footnotes at end of table.

TABLE 2.—*Number of localities from which samples of sumac* (Rhus) *were collected and number of samples taken*—Continued

Part of plant	Species	Tennessee Localities	Tennessee Samples	South Carolina Localities	South Carolina Samples	Georgia Localities	Georgia Samples	Alabama Localities	Alabama Samples	Florida Localities	Florida Samples	Mississippi Localities	Mississippi Samples	Louisiana Localities	Louisiana Samples	Texas Localities	Texas Samples	Iowa Localities	Iowa Samples	Total Localities	Total Samples
		Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Leaves	*R. aromatica*																	2	37	2	37
	R. copallina	17	20	3	3	13	13	1	1	2	5	3	3	4	4	7	7	1	11	101	228
	R. glabra	11	12	3	3	4	4	2	2							7	7	2	108	95	285
	R. lanceolata															17	23			17	23
	R. microphylla															5	5			5	5
	R. trilobata															24	34			24	34
	R. typhina	1	1															3	5	40	69
	R. virens															3	3			3	3
	Total		33		6		17		3		5		3		4		79		161		684
Leaflets and petioles [1]	*R. copallina*																	1	2	8	18
	R. glabra																	1	16	12	59
	R. typhina																	1	12	6	32
	Total		0		0		0		0		0		0		0		0		30		109
Stems	*R. aromatica*																	2	3	2	3
	R. copallina																	1	1	21	39
	R. glabra																	1	3	1	25
	R. lanceolata															6	6			6	6
	R. trilobata															6	6			6	6
	R. typhina																	1	3	11	21
	Total		0		0		0		0		0		0		0		12		10		100
Bark and wood [2]	*R. copallina*																			6	26
	R. glabra																			2	4
	R. typhina																			3	18
	Total		0		0		0		0		0		0		0		0		0		48
Flowers and seed [3]	*R. copallina*																			13	27
	R. glabra																			11	20
	R. typhina																			5	7
	Total		0		0		0		0		0		0		0		0		0		54
	Grand total (18 States).		33		6		17		3		5		3		4		91		201		995

[1] Leaflet samples and petiole samples are combined. There were equal numbers of each with the exception of 7 leaflet samples for which the corresponding petiole samples were not analyzed.

[2] Wood samples and bark samples are combined.

[3] Flower samples and seed samples are combined.

in Texas, which in some cases extended over several years, included six species, namely *R. copallina*, *R. glabra*, *R. lanceolata*, *R. microphylla*, *R. trilobata*, and *R. virens*.

A number of leaf and leaflet samples were obtained and analyzed after appendix tables 13 and 14 had been completed and a statistical study of the data had been made. Analyses of these extra samples are included in appendix table 18 to supply data for regions not represented in the earlier collections.

The individual leaf samples came from single plants, clumps, fields, and districts, as may be noted from table 13. Although clump collections represented single clones in most instances, two or more clones may have been intermingled in certain clumps. The samples from single plants and clones reflect the variation due to both genetic and environmental factors.

Collections from fields were made in a way that would give a good representation of all plants in the area. To accomplish this, a few leaves were taken from numerous individual plants well distributed over the entire stand. If the plants were growing on sloping ground or if there was wide variation in the condition of the ground, every effort was made to have the sample reasonably represent that particular stand of plants. Similar consideration was given to the distribution of the plants in shaded and unshaded locations. Collections representative of a district consisted of leaves from numerous fields usually located within several miles of each other. A few leaves were taken from several plants in each field, and the leaves from all the fields were then combined into a single sample. District collections represented an average for the particular section and presumably minimized the variation due to individual genetic factors or local conditions.

The general environment of the plants, their size, thriftiness, and stage of growth, and the color of their leaves were recorded. In most cases, an herbarium specimen was also obtained whenever a laboratory sample was collected. If the collection trip extended only over 1 or 2 days, the samples were placed in paper or cotton bags, in which they could be kept without damage in favorable weather, provided they were packed loosely and stirred occasionally.

Most of the samples in the southern Appalachian area and central Tennessee were collected on special trips, which extended over a week or more. During these trips, the samples could not be spread out to dry but were placed loosely in open mesh bags, such as those used for marketing onions and oranges, and suspended from the ceiling or sides of the collector's car. If they were taken out once a day, thoroughly mixed and replaced loosely, drying proceeded rather rapidly in fair weather. Rain or damp weather, however, caused discoloration of many samples. At the end of each trip, the samples were spread loosely on paper placed on wooden floors or benches in a well-ventilated room. They were dry in 2 to 4 days.

Although the principal samples collected were leaves, numerous samples of other parts of the plant were obtained also. In addition, some leaf samples were separated into leaflet and petiole-rachis portions, and some stem samples into wood and bark portions. Most samples were separated when fresh, but a few were separated after they were air-dry.

When dry, all samples were ground in a Wiley mill to pass a sieve having holes 2 mm. in diameter, then mixed and stored in glass mason jars. They were analyzed by the official hide powder method of the American Leather Chemists Association (*1*), the extraction procedure being that described by Clarke and Frey (*7*). This method specifies that the sample be extracted with boiling water, 2 liters of percolate being collected in 7 hours and the amount of material being adjusted so that there will be between 3.75 and 4.25 gm. of tannin per liter in the solution. The percolate or extract solution was cooled slowly and analyzed at 20° C.

The analytical procedures were as follows: An aliquot of the solution was evaporated, and the dried residue weighed to determine total solids. Part of the solution was filtered by the prescribed procedure, an aliquot evaporated, and the dried residue weighed to determine soluble solids. The total insolubles in the extractive comprised the difference between total solids and soluble solids. They consisted of matter soluble in hot water but insoluble in water at 20° C., plus any fine material that had passed mechanically through the cotton filter in the extraction tube during the extraction process. Non-tannin was determined by removing tannin from an aliquot with standard hide powder [6] under prescribed conditions, then evaporating the tannin-free solution and weighing the dried residue. The percentage of tannin was found by subtracting the percentage of non-tannin from the percentage of soluble solids. The value for purity of extractive was obtained by multiplying the value for tannin by 100 and dividing the result by the value for soluble solids. Purity is related to astringency in that a tanning liquor of low purity is milder or less astringent than one of high purity. As a rule, purity of fresh liquors lower than 50 is undesirable. All results were calculated on the moisture-free basis.

The statistical methods described by Snedecor (*19*) were used in analyzing the data.

RESULTS

Tables 13 to 18, inclusive, give the detailed analyses of the samples, as well as pertinent information regarding their source and condition. To avoid an excess of tabular material throughout the text, these tables are given in the appendix.

LEAVES

Appendix table 13 shows the detailed analyses of the leaves. The ranges are summarized in table 3. The data reveal extremely wide variability in tannin and other chemical components. Analysis of this variability in composition showed it to be associated with certain characteristics of the plants, with their environment, and with their geographic origin. Data on these factors are given in table 13. Data on other factors that might affect the tannin content or composition are not included because of the lack of samples comparable in all but

[6] Prepared from cattle hides; made only by Standard Hide Powder Co., Ridgway, Pa.

one of these factors. Type of soil; soil moisture conditions; associated vegetation, especially crowding by other plants; and perhaps elevation above sea level may affect tannin content, but this will have to be determined by further investigations. The associations established in this study are discussed in detail under the various factors.

TABLE 3.—*Ranges in composition of leaves of 8 species of sumac* (Rhus) *collected in the eastern part of the United States*

Species	Number of samples	Insolubles in extractive content	Soluble solids content	Nontannin content	Tannin content	Purity of extractive[1]
		Percent	*Percent*	*Percent*	*Percent*	*Percent*
R. aromatica	37	0.6–3.3	39.2–51.1	19.0–26.9	16.5–26.3	38–56
R. copallina	228	.7–8.1	34.5–63.3	13.8–27.3	12.9 45.1	37–72
R. glabra	285	.7–3.2	29.5–56.8	14.3–25.8	11.0–38.0	37–68
R. typhina	69	1.2–3.0	32.1–57.1	15.7–23.6	12.7–37.0	40–67
R. lanceolata	23	1.0–4.4	27.1–48.6	15.8–20.9	10.4–30.2	38–62
R. trilobata	34	.6–2.5	57.1–65.1	19.9–25.4	33.1–43.6	58–68
R. microphylla	5	1.1–4.1	46.6–38.6	22.1–26.1	16.5–21.0	43–46
R. virens	3	3.3–3.8	39.7–46.7	21.6–22.5	17.6–25.1	44–54

[1] The value for purity of extractive was calculated by dividing the percentage of tannin by percentage of soluble solids and multiplying by 100.

FACTORS AFFECTING COMPOSITION

SEX OF PLANT

Sumac plants are described botanically as polygamo-dioecious, that is, the same species may bear both bisexual and unisexual flowers. *Rhus copallina* and *R. glabra*, however, are mainly dioecious (bearing either male or female flowers).[7] A few plants are monoicous (having both male and female flowers on the same plant). Figure 11 shows a male inflorescence of *R. glabra* in bloom. In *R. copallina*, *R. glabra*, and *R. typhina*, there is little difference in general appearance between male and female inflorescences when they are in bloom, but after blooming the male flowers fall, leaving the bare stems (fig. 12), whereas a large seed cluster develops on female plants (fig. 13).

The association of sex and composition of leaves was determined by comparing analyses of samples collected on the same date from male and female plants growing in the same locality. A total of 35 *Rhus copallina* and 86 *R. glabra* samples were included in these comparisons. The samples used are listed in the appendix.

Table 4 gives the average values for *Rhus copallina* and *R. glabra* samples of each sex. Whether the differences between averages may be judged significant or due only to chance depends on the variation between samples of the same sex. This variability may be evaluated mathematically by calculating the standard errors, all individual values being used for each group. The standard errors of the differences between averages are given in table 4.

[7] In this investigation, plants having flowers with suppressed pistils were classed as males; those with suppressed stamens were classed as females.

FIGURE 11.—Male inflorescence of *Rhus glabra* in full bloom.

TABLE 4.—*Effect of sex on content of tannin and related constituents of leaves of* Rhus copallina *and* R. glabra

RHUS COPALLINA [1]

Sex	Average insolubles in extractive content	Average soluble solids content	Average nontannin content	Average tannin content	Average purity of extractive
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
Male	1.8	50.7	17.0	33.7	67
Female	1.9	47.9	17.5	30.4	63
Difference [2]	.1	**2.8	.5	**3.3	*4
Standard error	.14	.85	.67	1.09	1.6

RHUS GLABRA [3]

Sex	Average insolubles in extractive content	Average soluble solids content	Average nontannin content	Average tannin content	Average purity of extractive
Male	1.6	46.5	20.4	26.1	56
Female	1.6	47.5	20.0	27.5	58
Difference [4]	.0	1.0	.4	1.4	2
Standard error	.07	.82	.42	.85	1.1

[1] Based on 33 degrees of freedom, derived from 35 samples of male and female plants.
[2] *=significant difference (5 percent); **=highly significant difference (1 percent).
[3] Based on 84 degrees of freedom, derived from 86 samples of male and female plants.
[4] None significant.

The data show that male plants of *Rhus copallina* contained on an average 3.3 percent more tannin than female plants but that there were no significant differences between the sexes in nontannin and insolubles in extractive. The significantly greater tannin content of the male plants caused a correspondingly greater soluble solids content and purity of extractive in samples of this sex.

FIGURE 12.—Male inflorescence of *Rhus glabra* after nearly all the flowers have dropped.

The differences for *Rhus glabra* were not so great as those for *R. copallina.* None of the differences can be judged significant, even though a greater number of samples were available for the comparisons. It may be assumed, therefore, that sex did not influence the composition of *R. glabra* leaves.

FIGURE 13.—Seed cluster of *Rhus glabra*.

EXPOSURE TO SUNLIGHT

To test the influence of sunlight on the chemical composition of the leaves, comparisons were made between samples of the same sex that had been collected on the same date and at the same location but differed in exposure to sunlight. There were 31 samples of *Rhus copallina* and 44 of *R. glabra* suitable for this comparison. They are listed in the appendix. There were 8 location groups of the former species and 9 of the latter.

Table 5 gives the results of this comparison. The two species studied were consistent in their apparent response to light. The samples in full sunlight contained on the average 2.8 percent more tannin and 1.3 percent less nontannin than those in restricted sunlight. These differences are highly significant.

TABLE 5.—*Effect of exposure to sunlight on tannin and nontannin contents of leaves of* Rhus copallina *and* R. glabra [1]

Species	Average tannin content of leaves in—			Average nontannin content of leaves in—		
	Full sunlight [2]	Restricted sunlight [3]	Difference	Full sunlight [2]	Restricted sunlight [3]	Difference
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina	33.8	30.9	2.9	17.0	18.1	1.1
R. glabra	27.2	24.6	2.6	19.4	20.9	1.5
Average			[4 5] 2.8			[4 6] 1.3

[1] Based on 15 degrees of freedom, derived from a total of 75 samples collected from 17 locations.
[2] "Full sunlight" indicates that the plants were in a location fully exposed to the sun all day or practically all day.
[3] "Restricted sunlight" indicates that the plants were in the shade at least part of the time. The degree of shade or whether the plants were in the shade all day or only part of the day is not indicated. Since the collectors took samples in full sunlight whenever possible, not enough samples were available for satisfactory subdivisions of the restricted sunlight group.
[4] Highly significant difference (1 percent).
[5] Standard error, 0.84.
[6] Standard error, 0.46.

HEIGHT OF PLANT

To study the association between the height of the plant and composition of the leaves, comparisons were made between leaves from clumps of plants of different heights that were collected at the same time and location. The leaves of *Rhus copallina* were taken from plants of the same sex. There were 16 samples of *R. copallina* and 80 of *R. glabra*. They were assembled into 23 groups, consisting of 2 to 18 samples each. The samples are listed in the appendix. A linear regression line was drawn for each group. These individual lines were then averaged to give the regression line shown in figure 14. The regression coefficients were approximately the same for *R. copallina* and *R. glabra*, although for plants of equal height the samples of the former contained about 5 percent more tannin than the samples of the latter.

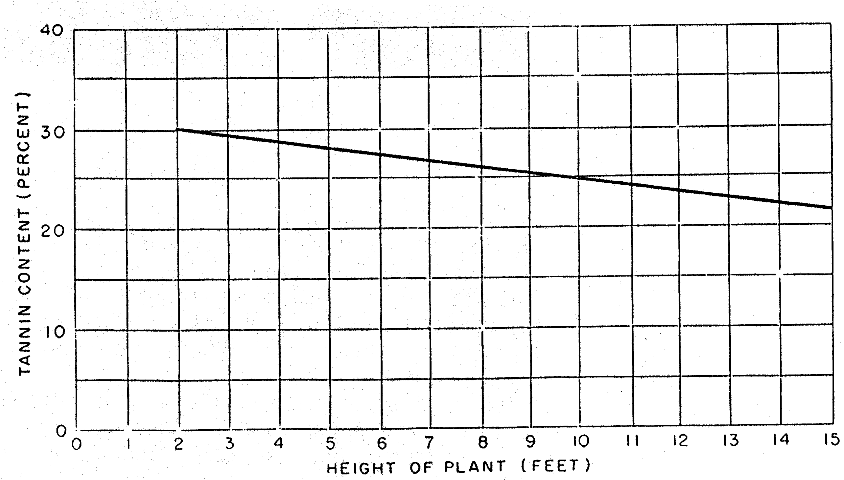

FIGURE 14.—Effect of height of plant on the tannin contents of *Rhus copallina* and *R. glabra* leaves.

The regression lines indicated that in both species the tannin content decreased with increase in height of the plant. On the average, the tannin content of the leaves decreased 0.61 percent for each foot of plant height, within the range shown in the figure.

The degree of association between height and tannin content can also be expressed as a correlation coefficient, the value being −0.3845. This value is highly significant, based on 51 degrees of freedom.[8]

The nontannin content showed no significant association with plant height, and therefore a regression line for this factor is not given. Since there was a significant association with tannin but none with nontannin, the purity and soluble solids were greater in the smaller plants.

DATE OF COLLECTION

The association between date of collection and composition of the leaves was determined by comparing leaves collected at different times within the year from the same clump of plants. In all, 59 clumps, consisting of 19 of *Rhus copallina*, 32 of *R. glabra*, and 8 of *R. typhina*, were sampled two or more times in the same season. Also 34 clumps were sampled in more than one season. A total of 224 samples were analyzed. They are listed in the appendix.

Since the tannin and other constituents varied among the different clumps, the regressions of date and chemical composition were first determined for each clump, then the separate regressions were grouped into an average regression for each species and finally into an average for all three species. Figure 15 shows the regression lines for tannin.

The results show that the tannin content declined during the summer. The average rate of decline was approximately similar in the three species, with a regression coefficient of −0.047 percent tannin per day between the middle of June and the middle of September. This coefficient indicates the average change in tannin content that may be expected during the summer in the leaves of the same plant, although the over-all tannin content may vary between different plants because of such factors as species, sex, height, and exposure to sunlight. The solid lines in figure 15 cover the range for which adequate data were available. In addition, at the ends of the regression line for *Rhus glabra*, there are broken lines based on five collections on May 26 and three collections on October 22. Although based on meager data, the broken lines indicate that the tannin content of *R. glabra* increased during the spring to a peak at the start of summer and also that the normal decrease during the summer was arrested in the fall and there may actually have been another period of increase in tannin. The significance of these reversals in trend is of only secondary importance, however, since it is unlikely that sumac leaves would be harvested at either of these times.

For the portion of the range shown in solid lines, the correlation coefficient of tannin content and date is −0.6198. This is a highly significant value, based on 130 degrees of freedom (*19*).

A similar analysis of the nontannin results for these samples was made, but no consistent or significant association with date was detect-

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[8] The 51 degrees of freedom are arrived at by subtracting 1 plus the number of groups (23) plus resamplings (21) of the same plants on different dates from the total number of samples (96).

able. The number of samples taken from the same plants of other species at different dates was insufficient for a valid analysis. There was some indication that the tannin content of *Rhus aromatica* decreased during the greater part of the summer, but the data were inadequate for a valid conclusion.

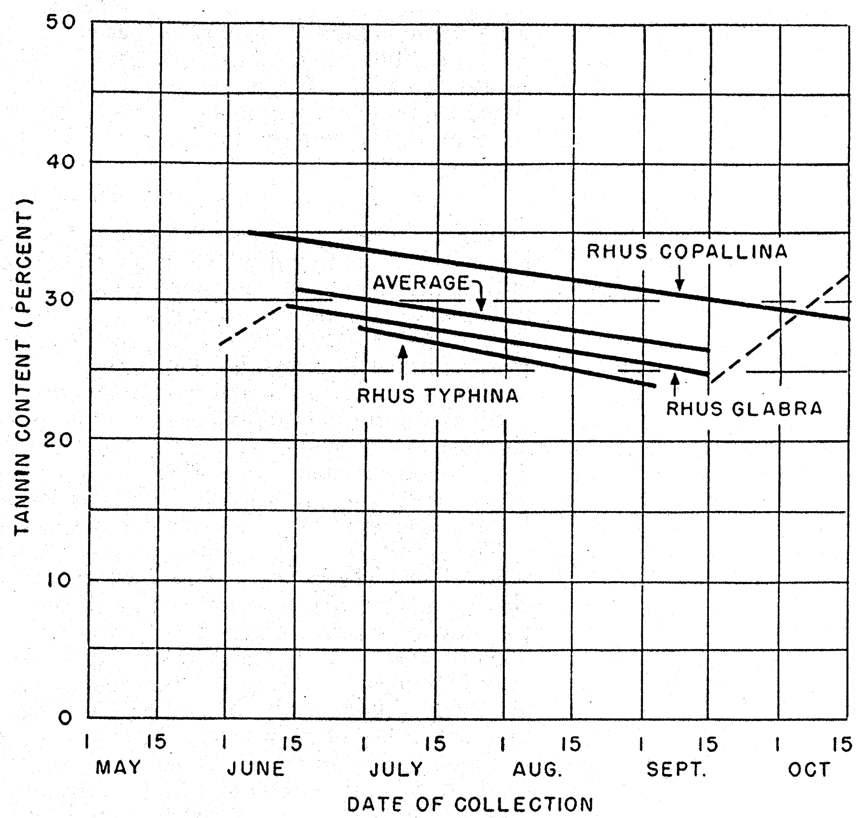

FIGURE 15.—Effect of date of collection on tannin contents of *Rhus copallina*, *R. glabra*, and *R. typhina* leaves.

CONDITION OF CURED LEAVES

Freshly picked sumac leaves darken rapidly if packed tightly. They also darken if aeration is poor or humidity high during the drying period. The samples in this study showed all gradations of discoloration and proportion of discolored leaves. They were classified according to general appearance into four groups (table 13, column 11). The significance of each grade was as follows: Good—only a few leaves were dark; fair—not more than one-third of the leaves were dark; poor—more than one-third of the leaves were dark or up to one-fourth were black; bad—more than one-fourth of the leaves were black. The darkest leaves were designated as black in accordance with common usage, although the actual color was dark brown.

A comparative study disclosed no association between tannin content and condition of the leaves for *Rhus copallina* and *R. typhina*. There appeared to be some association for *R. glabra*, but since a large proportion of the poor and bad samples came from a section of the country from which no "good" samples were obtained, an association was questionable. In view of these facts, only samples in good condition were used for later comparisons.

GEOGRAPHIC ORIGIN

The factors discussed thus far have been either individual plant characteristics, such as sex and height, or influences that apply locally, such as exposure to sunlight and date of collection. In addition to these factors, there is a possible geographic or regional variability in tannin content.

Some indications of geographic variability may be arrived at by taking State averages, but since plant distribution is influenced primarily by climate and soil, a classification based on political divisions is obviously artificial. Van Dersal's (*23*) natural system of geographic classification, based on Thornthwaite's climatic provinces and Mulford's plant-growth regions, was used here for establishing regional lines to determine whether there are differences due to geographic origin in the composition of sumac leaves.

Figure 16 shows the 10 zones adopted for this study. In establishing these zones, some of Mulford's regions were divided on the basis of Thornthwaite's climatic provinces. Mulford's region 27 was divided into a northern Appalachian zone [No. 2] and a southern Appalachian zone [No. 4]. His region 28 was divided into a southern New Jersey zone [No. 1] and a Piedmont zone [No. 3], and region 29 was divided into an Atlantic Upper Coastal Plain zone [No. 6] and a Gulf Upper Coastal Plain zone [No. 7]. This division of the Upper Coastal Plain into two parts was based on differences in the tannin contents of the plants, as will be shown later, and also on the fact that independent plantings of seed from these two sources showed that *Rhus copallina* in the Gulf States differs in certain leaf characteristics from the same species in the Atlantic States.[9] The location of the line could not be determined precisely because there was only one *R. copallina* sample from Alabama. It may well be that the division actually should lie several hundred miles west of the Georgia-Alabama border. The lack of precision in the division is indicated on the map by a broken line. The other zone divisions are shown by solid lines.

Table 6 gives the zone numbers and the corresponding numbers of Mulford's plant-growth regions, Thornthwaite's climatic province designations, the zone names, which are essentially the same as Mulford's region names, and the States in each zone.

The geographic variabilities of only *Rhus copallina*, *R. glabra*, and *R. typhina* were studied, as these species were sampled over a range covering several plant-growth regions (fig. 16). Since the other species were obtained from limited areas only, a study of their geographic variability was pointless.

Insofar as possible, all the usable samples of these three species were incorporated in this phase of the study. Since the samples differed

[9] Unpublished data.

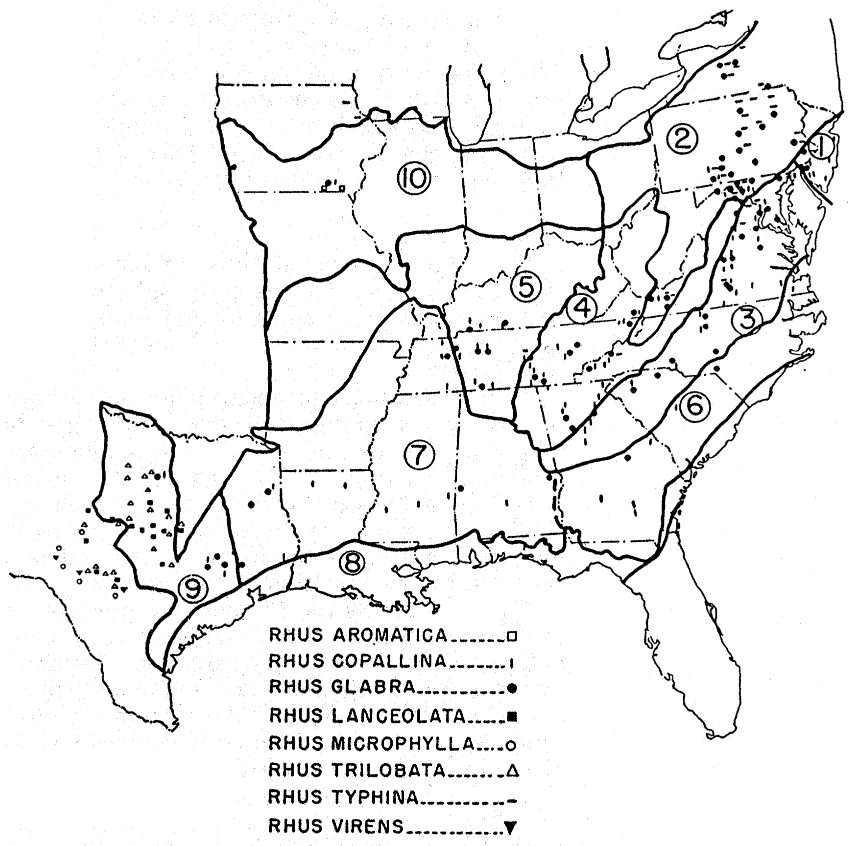

FIGURE 16.—Ten zones used for a study of geographic variability in the composition of sumac leaves. Samples of the different species were collected in the locations indicated.

in sex, exposure to sunlight, and other factors, it was necessary first to equalize for these effects before valid regional averages could be calculated. The following adjustments were therefore made in the analytical values.

SEX.—Applied to *Rhus copallina* only. Since the difference in tannin content between the sexes was 3.3 percent (table 4), one-half of this, or 1.6 percent, was subtracted from the tannin value for male plants and added to that for female plants. The tannin values for plants for which no sex data were available were not changed.

EXPOSURE TO SUNLIGHT.—Applied to *R. copallina*, *R. glabra*, and *R. typhina*.[10] The tannin values for samples from plants grown under restricted sunlight were adjusted to the equivalent of that for full sunlight by adding 2.8 percent; nontannin values were similarly adjusted by subtracting 1.3 percent (table 6).

[10] No data were available to test this adjustment for *R. typhina*, but the assumption seemed probable that shade had the same effect on this species as on the other two. This adjustment applied to 8 of the 31 samples, thus increasing the average tannin value 0.7 percent (from 24.9 to 25.6 percent).

TABLE 6.—*Tannin contents of leaves of* Rhus copallina, R. glabra, *and* R. typhina *in 10 geographic zones (moisture-free basis)*

Zone			Mulford's plant-growth region	Thornthwaite's climatic province [1]	*R. copallina* [2]			*R. glabra* [4]		*R. typhina* [5]	
No.	Name	States			Samples	Average tannin content	Geographic area [3]	Samples	Average tannin content	Samples	Average tannin content
					Number	*Percent*		*Number*	*Percent*	*Number*	*Percent*
1	Southern New Jersey	New Jersey	28	BC'r	15	26.6	I	5	22.7	3	20.4
2	Northern Appalachian	New York, Pennsylvania, Maryland, Virginia.	27	do	3	30.2	I	53	27.9	12	25.3
3	Piedmont	Maryland, Virginia, North Carolina, South Carolina, Georgia.	28	BB'r	51	32.7	II	27	26.8	8	26.6
4	Southern Appalachian	North Carolina, Georgia, Tennessee.	27	BB'r and AB'r	10	34.8	II	9	26.9	3	29.9
5	Ozark, Ohio, and Tennessee River Valleys.	Tennessee, Kentucky	25	BB'r	2	38.6	III	1	27.4	0	
6	Atlantic Upper Coastal Plain	Virginia, North Carolina, South Carolina, Georgia.	29	do	11	26.9	I	0		0	
7	Gulf Upper Coastal Plain	Alabama, Mississippi, Louisiana, Texas.	29	do	13	37.8	III	4	27.5	0	
8	Swampy Coastal Plain	Florida	30	do	5	34.5	III	0		0	
9	Southern Black Soils	Texas	20	CB'r and CB'd	5	35.1	III	4	28.0	0	
10	Central Prairies	Iowa	22	CC'r	3	37.0	III	33	27.4	5	25.2
	Total or grand average				118	32.44		136	27.3	31	25.6

[1] A=wet, B=humid, C=subhumid, B'=mesothermal, C'=microthermal, r=moisture abundant at all seasons, d=moisture deficient at all seasons.
[2] Differences between date of collection, light conditions, height of plant, and sex were equalized.
[3] Based on tannin content.
[4] Differences between date of collection, light conditions, and height of plant were equalized.
[5] Differences between date of collection and light conditions were equalized.

Height.—Applied to *Rhus copallina* and *R. glabra*. Variation in height was equalized to a standard of 5 feet by adding 0.6 percent to the tannin value for each foot more than 5 feet, and subtracting the same amount for each foot less than 5 feet (fig. 14). Five feet was selected as a standard height because it was the approximate average for all samples.

Date of Collection.—Applied to *Rhus copallina*, *R. glabra*, and *R. typhina*. Differences in date of collection were standardized to July 31 by adding 0.047 percent to the tannin values for each day of sampling after July 31, and subtracting a like amount for each day before July 31 (fig. 15). This date was selected because it was close to the average date of all collections.

These adjustments made it possible to compare the various samples directly and to discern regional differences of smaller magnitude than was possible with unadjusted data.

Only samples that were in good condition after curing (table 13, column 11) were used for the regional comparisons, because it was thought that poor curing might have altered the tannin content. In all, 186 samples of *Rhus copallina*, 253 of *R. glabra*, and 52 of *R. typhina* were available for the geographic comparisons. Some of these samples, however, had been taken from the same plants at different times. After the tannin values had been adjusted for differences due to date of collection, they became merely the equivalent of duplicate determinations. In order not to give undue weight to plants which had been sampled more than once, analyses of such duplicates were averaged and used as a single value in the geographic comparisons. The analyses for use in the regional comparisons were then 118 of *R. copallina*, 136 of *R. glabra*, and 31 of *R. typhina*.

Table 6 gives the average adjusted tannin contents of samples from the ten zones and the number of samples. Since the variability among the zones was greater in *Rhus copallina* than in the other two species, the data for this species were examined first. The ordinary *t*-test of statistical analysis (*19*) was used to determine whether the differences in tannin content between adjacent zones were significant. In this test, the variation between zones is compared with the variation within zones, the number of samples involved in each comparison being taken into account. On this basis, certain zones did not differ significantly in tannin value, and accordingly were grouped into an area. In all, the following three areas became apparent for *R. copallina:* A northern Appalachian and Atlantic Costal Plain (eastern) area (I), comprising zones 1, 2, and 6; a southern Appalachian and Piedmont area (II), comprising zones 3 and 4; and a central area (III), comprising zones 5, 7, 8, 9, and 10. The average tannin contents of the three areas (I, II, and III) were 27.05, 33.09, and 36.68 percent, respectively.

Figure 17 shows frequency distributions for the samples of *Rhus copallina* in each of the geographic areas. Although there is some overlapping in the ranges, the data indicate a definite difference between the groups. This conclusion is borne out by the analysis of variance in table 7. The nonsignificant mean square of 18.42 shown in this table indicates that the zones in each area had approximately similar average tannin values. The differences between the three areas, however, are highly significant, as indicated by the large mean square of 685.25.

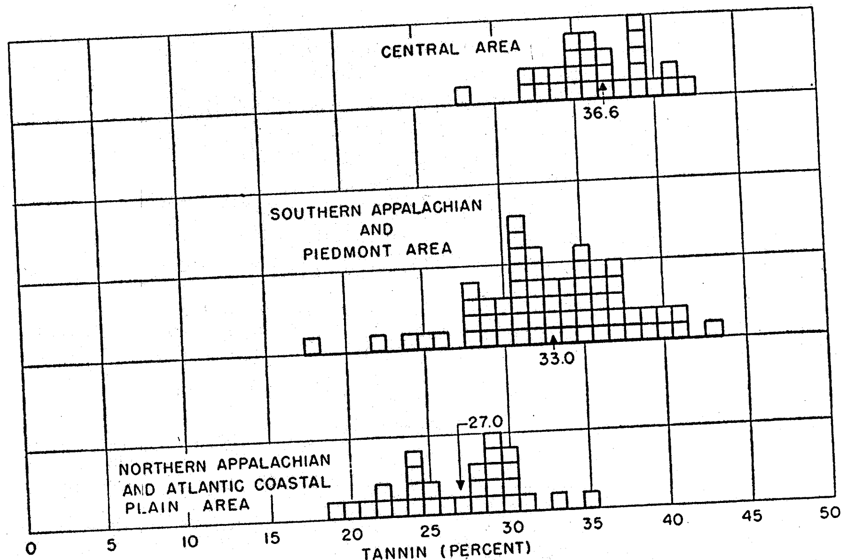

FIGURE 17.—Histogram showing frequency distribution based on tannin content for samples of *Rhus copallina* in each geographic area.

TABLE 7.—*Analysis of variance of tannin contents of* Rhus copallina *leaves in 10 plant-growth zones grouped into 3 geographic areas*

Source of variation	Degrees of freedom	Sum of squares	Mean square [1]
Between 3 areas	2	1,370.50	**685.25
Between zones within areas	7	128.91	18.42
Between samples in same zone (error)	104	1,858.02	17.87
Total	113	3,357.43	----------

1 **=highly significant difference (1 percent).

Zonal differences in the tannin contents of the leaves of *Rhus glabra* and *R. typhina* were not apparent. As shown in table 6, the tannin contents of the New Jersey samples of these two species were lower than the averages for the species, but the number of samples from this State was too small to give meaningful averages. In general, *R. glabra* and *R. typhina* did not show the distinct geographic variability noted in *R. copallina.*

No apparent geographic variability in the nontannin contents of the three species was indicated. In general, the range of nontannin values was much less than that of the tannin values and appeared to be unrelated to source. Rate of drying, however, affects the nontannin content. In another study (*8*), it was found that nontannin may be reduced by as much as 6 percent during slow drying, apparently by some type of decomposition. Changes in the original nontannin contents of the samples due to variations in rate of drying might have been sufficient to overshadow differences caused by geographic factors.

COMPARISON OF SPECIES

CHEMICAL COMPOSITION

The data for *Rhus copallina*, *R. glabra*, and *R. typhina* were adjusted to equalize for differences in sex, exposure to sunlight, height, and date of collection before comparisons were made of the chemical composition of the eight species. The original data were used for the remaining species, as the data available were insufficient for calculating adjustments.

Table 8 shows the average tannin, nontannin, and insolubles in extractive contents of leaf samples of each species of sumac. These averages represent the most valid estimates obtainable from the data.

TABLE 8.—*Tannin, nontannin, and insolubles in extractive contents and fiducial limits, at 5-percent level, of leaves of 8 species of sumac* (Rhus) (*moisture-free basis*)

Species [1]	Tannin content		Nontannin content		Insolubles in extractive content	
	Average	Fiducial limits	Average	Fiducial limits	Average	Fiducial limits
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. aromatica	21.76	20.86–22.66	22.91	22.17–23.65	2.02	1.80–2.27
R. copallina (I)	27.05	25.36–28.74	18.58	17.84–19.32	1.80	1.57–2.08
R. copallina (II)	33.09	31.88–34.30	18.78	18.23–19.33	1.88	1.76–2.01
R. copallina (III)	36.68	35.31–38.05	19.21	18.40–20.02	2.06	1.88–2.25
R. glabra	27.28	26.69–27.87	19.62	19.31–19.93	1.70	1.65–1.76
R. lanceolata	22.01	19.67–24.35	18.35	17.76–18.94	2.30	1.94–2.77
R. microphylla [2]	19.32	----------	24.50	----------	2.07	----------
R. trilobata	39.14	38.29–39.99	22.52	22.07–22.97	1.49	1.34–1.67
R. typhina	25.60	23.87–27.33	19.86	19.22–20.50	1.83	1.72–1.96
R. virens [2]	20.37	----------	22.07	----------	3.55	----------

[1] Roman numerals indicate geographic type (table 6).
[2] The number of analyses was probably insufficient to represent an adequate sample for these species.

Fiducial limits are given in table 8 for each average. They were calculated from the standard errors of the means and the number of observations, according to the method given by Snedecor (*19, p. 64*), and represent the range of the means at the 5-percent level of probability. Insofar as the collections were adequately random samples of the species, the odds are 19 to 1 that the true mean for the species lies between these limits.

The highest average tannin content, approximately 39 percent, was found in *Rhus trilobata*. The fiducial limits indicate that the tannin content of the leaves of *R. trilobata* was definitely higher than that of any other species included in the study.

The second highest average tannin content, 36.68 percent, was shown by *Rhus copallina* from the central area (III); the third highest, approximately 33 percent, was shown by this species from the southern Appalachian and Piedmont area (II). The means for these types differed beyond the 5-percent level of probability, since their ranges at the fiducial limits did not overlap.

Rhus glabra and the eastern area (I) type of *R. copallina* were essentially similar in their content of tannin. The average for *R. typhina* was slightly lower, being 25.6 percent as compared with about 27 percent for the other two species, but the probable ranges of the means indicate that the difference was not significant.

The remaining four species, *Rhus aromatica*, *R. lanceolata*, *R. microphylla*, and *R. virens*, constituted a group in which the average tannin contents of the leaves were relatively low, the range being from 19.32 to 22.01 percent. The two last-named species were represented by only five and three analyses, respectively, and although the values were fairly consistent, the sampling was no doubt insufficient to provide more than an approximate indication of their actual tannin averages.

The nontannin contents of the leaves also differed significantly among the species. *Rhus microphylla* had the highest nontannin value, 24.50 percent; *R. aromatica*, *R. trilobata*, and *R. virens* had the next highest values, ranging from 22.07 to 22.91 percent; and *R. lanceolata* had the lowest value, 18.35 percent. All these species were collected in Texas except *R. aromatica*, which was collected in Iowa. In the remaining species, nontannin ranged from 18.58 to 19.86 percent.

The values for insolubles in extractive give a highly skew distribution. Thus from table 13 it is evident that the average for *Rhus copallina* is in the vicinity of 2.0 percent, yet the range extends as high as 8.1 percent (for sample 73) but only as low as 0.7 percent (for sample 138). The range above the average is much greater than that below the average. Further study of the data revealed that the skew distribution could be rectified by transforming the values according to the following formula:

$$\text{Transformed value} = \frac{1}{\text{original value} + 1.00}$$

When the data were thus rectified, the distributions became nearly normal. The transformed values, expressed as decimals, were used to calculate means and fiducial limits for each species, after which the values were transformed back to percentages for presentation in table 8. As a result of these transformations, the positive range from the mean is somewhat greater than the negative range. For example, the mean for *R. copallina* of the eastern type is 1.80 percent, and the range is from 1.57 to 2.08 percent. The range is 0.23 below the mean and 0.28 above the mean. This difference in limits on each side of the average reflects the skew distribution of the data.

The averages and their limits in table 8 indicate significant differences in insolubles in extractive between the species. The highest average was obtained for the three samples of *Rhus virens*, and the next highest for *R. lanceolata*. The lowest averages were found for *R. glabra* and *R. trilobata*. Among the area types of *R. copallina*, changes in insolubles in extractive paralleled those in tannin, although this relationship did not hold between species.

EFFECT ON COLOR OF SKIVERS

To learn something of the color that the various species of sumac would impart to leather, sheepskin skivers [11] were tanned in the laboratory with leaves of *Rhus coriaria* (Sicilian sumac) and of each species studied here except *R. typhina*. The skivers were divided along the backbone line into halves, and each half was tanned with

[11] The grain split or hair-side layer of a sheepskin.

a sample of a different species so that comparisons of species could be made on the same skiver. A total of 12 skivers or 24 pieces were tanned. Only color comparisons were made. Every skiver, however, appeared to be well tanned.

The differences in color between the leathers can be described in terms of lightness, hue, and saturation. In general, the lighter leathers were characterized by a light-yellow or pinkish hue, and the darker leathers by a lowered reflectance and a dull-yellow, brown, or pronounced pink appearance.

Immediately after tannage, there was little difference in lightness between the leathers tanned with *Rhus coriaria*, *R. microphylla*, *R. glabra*, and *R. trilobata*. One of the 4 pieces tanned with *R. trilobata* was lighter than any of the other 24 pieces, but in general this leather was slightly pinker than that tanned with *R. coriaria*. *R. copallina* and *R. lanceolata* produced leathers that were pinkish, the latter producing a somewhat darker leather than the former. *R. virens* produced a light-brown leather that was slightly darker than that tanned with *R. lanceolata* but not so dark as the reddish-brown leather made with *R. aromatica*.

After aging for 5 years in the dark, the leathers were again compared for both relative lightness and pinkness. The eight *Rhus coriaria* pieces and the one *R. glabra* piece were lightest and had no pink cast. The *R. microphylla* leather was nearly as light as the *R. coriaria* leather. Only one piece, however, was tanned, and it was a rather nonuniform mixture of pink and green that resulted in a decided yellow shade. There were no appreciable differences in either lightness or pinkness between the leathers tanned with *R. copallina*, *R. lanceolata*, and *R. trilobata;* these leathers were slightly darker and pinker than the *R. coriaria* leather. *R. aromatica* and *R. virens* produced leathers that were reddish brown, of a shade about like that of bleached sole leather. The *R. aromatica* leather was somewhat lighter than the *R. virens* leather but too dark to be of interest to a tanner using sumac.

In view of the great variability in the color of the skivers, due to irregularities in both the skivers and in samples of the same species of sumac, the only conclusion that can safely be drawn from these results is that any of the species except *Rhus aromatica* and *R. virens* may produce leather of satisfactory color.

In a commercial test reported elsewhere (*9*), no readily apparent differences were found between the colors or other properties of leathers tanned with *Rhus copallina*, *R. coriaria*, *R. glabra*, and *R. typhina*.

Leaflets and Petiole-Rachises

Appendix table 14 gives analyses of leaflets and petiole-rachises for *Rhus copallina*, *R. glabra*, and *R. typhina*. The data are summarized in table 9. The tannin content of the leaflets was high, that of *R. copallina* and *R. glabra* being about the same (31 percent) and the value for *R. typhina* being 5.7 percent lower. The petiole-rachises of *R. glabra* and *R. typhina* were low in tannin. The average for *R. copallina* was about twice as high as that for the other two species, probably because the *R. copallina* rachis is "winged" (edged with a bladelike wing between the leaflets). The wing, which was left on the rachis, probably contained about the same percentage of tannin as the leaflet material. Although tannin in the leaflets of all species was high, the rather large proportion of petiole-rachis material, which had a low tannin content, resulted in an appreciably lower tannin content for the entire leaf. For example, the tannin contents of leaflets of *R. glabra* and *R. typhina* were 31.0 and 25.2 percent, respectively, but the values for the whole leaf were 25.7 and 19.8 percent.

TABLE 9.—*Tannin and nontannin contents of leaflets and petiole-rachises*[1] *of 3 species of sumac* (Rhus)

Species	Leaf samples	Proportion of leaflets in leaves	Average tannin content of—			Average nontannin content of—		
			Leaflets	Petiole-rachises	Whole leaf[2]	Leaflets	Petiole-rachises	Whole leaf[2]
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina	8	81.5	30.8	10.9	27.1	19.4	19.0	19.3
R. glabra	27	79.1	31.0	5.6	25.7	21.0	18.0	20.4
R. typhina	15	74.6	25.2	4.1	19.8	22.4	18.2	21.3

[1] The petiole and rachis are sometimes called leaf stem and midrib, respectively.
[2] Calculated from values for leaflets and petiole-rachises.

Leaflets and petiole-rachises did not differ greatly in nontannin, nor did the species.

STEMS

Analyses of the stems of six species of sumac are given in appendix table 15, and table 10 summarizes the tannin and nontannin data. The tannin content was uniformly low in all species examined, not exceeding 7.9 percent for any sample or 5.8 percent for the average in any species. Inclusion of stems would obviously have a drastic effect in decreasing the tannin yield per unit weight of sumac.

TABLE 10.—*Tannin and nontannin contents of stems of 6 species of sumac* (Rhus)

Species	Samples	Average tannin content	Average nontannin content
	Number	*Percent*	*Percent*
R. aromatica	3	5.8	17.7
R. copallina	39	4.2	14.4
R. glabra	25	5.1	15.6
R. lanceolata	6	3.2	12.2
R. trilobata	6	5.4	11.8
R. typhina	21	3.1	14.3

BARK AND WOOD

Appendix table 16 gives the analyses of the separated bark and wood of 23 samples of sumac stems. Table 11 gives their average tannin and nontannin contents. In each of the three species examined, the bark had a much higher tannin content than the wood, tannin in the latter being negligible. Tannin in the stems, therefore, is derived largely from the bark.

TABLE 11.—*Tannin and nontannin contents of bark and wood from the same stems of 3 species of sumac* (Rhus)

Species	Stems	Proportion of bark in stems	Average tannin content of—			Average nontannin content of—		
			Bark	Wood	Whole stem [1]	Bark	Wood	Whole stem [1]
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina	12	25.3	12.4	0.6	3.6	22.8	6.9	10.9
R. glabra	2	36.8	8.6	1.0	3.8	26.6	9.2	15.6
R. typhina	9	23.8	9.6	.8	2.9	27.0	6.1	11.1

[1] Calculated from values for bark and wood.

Nontannin content was much higher than tannin in both bark and wood. As a result, the nontannin content of stems was three to four times the tannin content. Therefore the purity of a sumac extract would be reduced if stems were extracted with leaves.

According to ring counts, the samples of stems ranged in age from 1 to 22 years. No relation between age and composition is evident from the data presented.

FLOWERS AND SEED

Sumac flowers, although classed here as either male or female, may also have organs of the opposite sex, as was pointed out in footnote 7, p. 23. The data on inflorescences, therefore, should be examined rather conservatively. Appendix table 17 gives analyses of flowers and seed. In table 12, a comparison is given of male and female inflorescences of *Rhus copallina* and *R. glabra*. The tannin contents of the inflorescences were high, comparing favorably with those of the leaves. Female inflorescences of both species were appreciably higher in tannin than male inflorescences, and *R. copallina* inflorescences of both sexes were higher in tannin than were those of *R. glabra*.

TABLE 12.—*Tannin and nontannin contents of male flowers and of female flowers and seed clusters of sumac* (Rhus)

Species	Sex	Stage of development	Samples analyzed	Average tannin content	Average nontannin content
			Number	*Percent*	*Percent*
R. copallina	Male	Flowering	8	28.6	22.5
	Female	Flowering	4	39.5	17.7
		Seed forming	7	20.2	17.9
		Seed formed	3	16.4	15.7
		Old seed cluster	1	3.2	9.9
R. glabra	Male	Flowering	5	21.4	23.0
	Female	Seed forming	4	30.1	22.0
		Seed formed	9	10.0	12.5
R. typhina	Female	Seed formed	7	10.5	15.0

Table 12 also gives a comparison of female inflorescences of *Rhus copallina* in various stages of development from flowers to seed. The tannin content was highest at the flowering stage and decreased as the seed formed and ripened. Apparently this was also true for *R. glabra*. Since the old *R. copallina* seed cluster, which contained only 3.2 percent tannin, was taken in the second year, it probably had lost considerable tannin by weathering.

Nontannin in female inflorescences also decreased as the seed formed and ripened, but the decrease was less pronounced than that for tannin.

DISCUSSION

In this bulletin, consideration has been given principally to two phases of the commercial utilization of sumac: (1) The amount available from wild stands and (2) the tannin content.

It was found that there is an abundance of sumac growing wild. A survey showed that a strip about 31 miles wide across southern Virginia contained an amount equal to at least 10 times the normal prewar amount consumed annually, both domestic and imported. The area involved is only a small fraction of that in which collectible amounts of sumac grow. Supplies adequate for commercial needs, therefore, are growing wild, but the amounts collected have not been sufficient to meet the demand.

There is little hope for a substantial increase in the price of domestic sumac unless its quality is improved considerably. This may be accomplished by exercising greater care when gathering and drying it. Stems, for example, contain almost no tannin and should not be included with leaves. Flowers in bloom are high in tannin, but seeds, even when immature, should not be gathered, because they are low in tannin and also impart an undesirable color to leather. Some improvement in quality should result if collections were made principally in regions that contain strains of sumac of high tannin content.

Before considering the other phase of the sumac problem, that of the average tannin contents of domestic species, the tannin content of commercial Sicilian sumac should be of interest, as it is the chief competitor of the domestic product. Data for individual samples of leaves of *Rhus coriaria* known to be free of stems are not available, but it seems reasonable to suppose that they would show much the same variation in tannin content due to genetic and environmental factors as do domestic sumacs. The imported product has been processed by fanning and screening, and so may not have the normal ratio of leaflets to other parts of the plant, but undoubtedly it has a tannin content close to that of pure *R. coriaria* leaves. Average values, on the moisture-free basis, for 65 samples of commercial Sicilian sumac taken in the United States at ports of entry in 1905 (*24*) were (in percent): Tannin, 34.7; nontannin, 20.6; and insolubles in extractive, 4.6. Four samples analyzed from 1937 to 1939 showed tannin, 31.7 percent; nontannin, 19.7; and insolubles in extractive, 2.3.

The average tannin content of the commercial, imported material thus was higher than that of any domestic species except *Rhus copallina* from the central area (III) and *R. trilobata*. Nontannin in the foreign and domestic sumac was essentially the same.

Importers of ground sumac for use in direct tanning often purchase it on the basis of 28 percent tannin in the air-dry material and may reject shipments that contain less than 26 or 27 percent. Dealers in Sicily obtain this guaranteed tannin content by mixing and blending various small lots. Since the average moisture content of ground Sicilian sumac is about 7 percent, 28 percent on the air-dry basis corresponds to a little over 30 percent on the moisture-free basis. Two domestic species, *Rhus trilobata* and *R. copallina*, have average tannin contents that exceed this minimum, and could be supplied under such a guaranty, provided the sumac industry were organized in the United States as it is in Sicily. An organized industry could exercise better control over other factors that affect sumac quality, such as color and purity, and would also provide a dependable source of supply.

Any of the species studied might possibly find use locally under certain circumstances, but from the point of view of both the tanner and the collector the commercial use of one or at most two species would be preferable. The question then arises as to which species are the most promising.

From the results obtained in this study, the relative merits of the various species and their probable commercial value may be summarized as follows: All factors seem favorable for three species, *Rhus copallina*, *R. glabra*, and *R. typhina*. They are well distributed and abundant, and they have numerous, large leaves of satisfactory tannin content. In a commercial test (*9*), all three made good leather. From available data, no choice between the three can be made, and it is doubtful if one should be attempted. The eastern United States may be divided into three regions according to predominating species, as shown in figure 9. Probably it would prove most profitable to use all three species, collecting each in the region where it predominates.

Rhus trilobata, although it has small leaves and is not well distributed, might be of value because it has a high, uniform tannin content, produces light-colored leather, and grows in a region where drying conditions during harvest time are favorable. Machine handling might make the use of this plant possible, notwithstanding the fact that it has only a small amount of leaf material per plant. The next step in the evaluation of this species should be a commercial tanning test.

The remaining four species, *Rhus aromatica*, *R. lanceolata*, *R. microphylla*, and *R. virens*, probably merit little further consideration because they are of limited distribution, they are not abundant, and they are low in tannin. Also, *R. microphylla* has small leaves, and *R. aromatica* and *R. virens* appear to produce leather of poor color.

Although this bulletin is concerned only with wild plants, it might not be amiss to consider briefly some of the advantages of growing sumac as a crop. Quality could be improved and controlled by propagating selected high-quality strains, some of which are already available; similar improvement of wild stands would be impossible. Mechanical harvesting and handling should result in lower cost of production and should be much more easily applied to a cultivated crop than to wild stands. Owing to the nature of the tanning operation, the tanner has difficulty in using a tanning material if its quality is variable or the supply is erratic. A cultivated crop would have a decided advantage over the wild crop with respect to uniformity and dependability of supply. Finally, growing sumac as a crop on poor land would fit into the soil conservation program because of the value of sumac for controlling erosion. The data presented here should be of considerable assistance to prospective growers of sumac in selecting locations for operation and in choosing species and strains for propagation.

SUMMARY

Eight species of sumac (*Rhus*) that grow wild in the eastern and southern parts of the United States were studied to determine their tannin contents and abundance. A brief description of each species is given, including the geographic range in which it grows and the range in which collection of certain species for commercial use might be profitable.

An intensive survey of the quantity of sumac growing wild in an area of approximately 12,000 square miles in the southernmost tier of counties of Virginia indicated that about 43,000 long tons of dry sumac leaf would be available there annually.

Approximately 684 samples of leaves and 311 samples of other parts of the plant were analyzed for tannin and related constituents. Leaves, leaflets, and flowers were high in tannin. Petioles, rachises, stems, bark, wood, and seed were low in tannin, and consequently their inclusion with leaves would reduce the quality of the latter appreciably, especially since they were also low in purity of extractive.

A statistical study of the effects of various genetic and environmental factors on the composition of the leaves of *Rhus copallina*, *R. glabra*, and *R. typhina* revealed the following relations.

The leaves of male plants of *Rhus copallina* contained, on the average, 3.3 percent more tannin than those of female plants. No significant difference in tannin content was found between male and female plants of *R. glabra*.

Leaves of *Rhus copallina* and *R. glabra* growing in partial shade contained an average of 2.8 percent less tannin and 1.3 percent more nontannin than leaves of similar plants in full sunlight.

The tannin contents of *Rhus copallina* and *R. glabra* leaves varied inversely with the height of the plant. There was a decrease of 0.61 percent in the average tannin content of the leaves for each foot of increase in height of the plant.

The date of collection also influenced the tannin content. There was an average decrease in tannin of 0.047 percent per day during the summer.

The condition of the leaves of *Rhus copallina* and *R. typhina* did not affect their tannin contents.

The average tannin content of *Rhus copallina* varied significantly in three geographic areas. They were: An eastern area (I); a southern Appalachian and Piedmont area (II); and a central area (III). No geographic variability in tannin content of the leaves of *R. glabra* or *R. typhina* was found.

The average tannin content of moisture-free leaves of each species was (in percent): *Rhus trilobata*, 39.14; *R. copallina* (area III), 36.68; *R. copallina* (area II), 33.09; *R. glabra*, 27.28; *R. copallina* (area I), 27.05; *R. typhina*, 25.60; *R. lanceolata*, 22.01; *R. aromatica*, 21.76; *R. virens*, 20.37; and *R. microphylla*, 19.32. The average nontannin contents ranged from 24.5 percent in *R. microphylla* to 18.35 in *R. lanceolata*. The average nontannin values of the three most widely

distributed species, *R. copallina*, *R. glabra*, and *R. typhina*, were between 18.58 and 19.86 percent. Insolubles in extractive values were highest (3.55 percent) in *R. virens* and lowest (1.49 percent) in *R. trilobata*.

Limited tests indicated that any of the species except *Rhus aromatica* and *R. virens* would produce leather of satisfactory color.

The data indicate that *Rhus copallina*, *R. glabra*, and *R. typhina* are most promising for commercial development and that *R. trilobata* might prove of value under certain circumstances. The remaining four species, *R. aromatica*, *R. lanceolata*, *R. microphylla*, and *R. virens*, have objectionable features that would probably prevent their successful competition with the other four species.

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APPENDIX

Detailed Analyses

Table 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)

Species and sample No.[1]	Source: State	Source: County	Source: Locality[2]	Source: Stand[3]	Date collected	Description: Exposure to sunlight	Description: Height of plant	Description: Sex[4]	Description: Color of leaves when collected	Description: Condition of cured sample	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive[5]
R. aromatica Ait.:							*Feet*				*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1	Iowa	Van Buren	Keosauqua	Clone	Sept. 3, 1938	Restricted	2		Green	Good	2.5	42.4	22.2	20.2	48
2		do	do	do	Sept. 5, 1938	do	2		do	do	2.2	42.8	23.3	19.5	46
3a		Davis	Floris	do	Sept. 2, 1938	Full	2		do	Fair	2.1	42.0	19.4	22.6	54
3b		do	do	do	Aug. 2, 1939	do	3		do	Good	2.5	47.6	22.1	25.5	54
3c		do	do	do	Sept. 8, 1939	do	3		Turning	do	2.6	45.3	20.9	24.4	54
3d		do	do	do	July 29, 1940	do	3		Green	do	1.6	46.8	23.2	23.6	50
3e		do	do	do	Sept. 5, 1940	do	3		Partly red	do	1.7	44.6	26.0	18.6	42
4a		do	do	do	Sept. 13, 1939	do	3		Green	do	2.3	42.5	19.0	23.5	55
4b		do	do	do	June 27, 1940	do	5		do	do	1.2	47.7	21.4	26.3	55
4c		do	do	do	July 29, 1940	do	5		do	do	1.9	47.4	24.9	22.5	47
4d		do	do	do	Sept. 5, 1940	do	5		Turning	do	2.0	47.5	24.7	22.8	48
4e		do	do	do	June 10, 1943	Restricted	5		Green	do	.6	39.2	20.0	19.2	49
4f		do	do	do	July 3, 1943	do	5		do	Fair	.8	44.4	23.2	21.2	48
4g		do	do	do	Aug. 8, 1943	do	5		do	Good	1.2	43.6	24.6	19.0	44
5a		do	do	do	Oct. 19, 1938	Full	2		Partly red	do	2.7	47.0	21.5	25.5	54
5b		do	do	do	Aug. 3, 1939	do	3		Green	do	3.3	47.5	23.3	24.2	51
5c		do	do	do	Sept. 7, 1939	do	3		do	do	2.6	45.7	20.0	25.7	56
6a		do	do	do	Oct. 5, 1938	Restricted	3		Partly red	do	2.4	43.2	25.1	18.1	42
6b		do	do	do	Sept. 7, 1939	do	3		Green	do	1.9	43.4	22.5	20.9	48
7a		do	do	do	Oct. 19, 1938	Full	3		Partly red	do	2.6	43.6	21.3	22.3	51
7b		do	do	do	Sept. 7, 1939	do	4		do	do	2.0	41.1	19.4	21.7	53
8		do	do	do	Sept. 1, 1938	do	2		Green	do	2.3	39.2	21.4	17.8	45
9		do	do	do	Sept. 15, 1938	do	3		Turning	do	2.3	51.1	25.4	25.7	42
10		do	do	do	Oct. 5, 1938	Restricted	2		Partly red	do	2.5	43.6	26.9	16.7	38
11		do	do	do	do	do	2		do	do	2.5	44.5	23.5	21.0	50
12		do	do	do	Oct. 19, 1938		2		do	do	2.5	41.3	19.8	21.5	52
13		do	do	do	Sept. 13, 1939	Full	2		Green	do	1.9	42.6	22.1	20.5	48
14		do	do	do	Sept. 18, 1939	do	3		do	do	2.3	44.3	23.6	20.7	47
15		do	do	do	do	Restricted	2		Turning	do	2.4	45.6	21.5	24.1	53
16		do	do	do	do	do	2		do	do	2.1	43.6	25.8	17.8	41
17		do	do	do	Sept. 20, 1939	do	2		do	do	2.2	41.6	25.1	16.5	40
18		do	do	do	do	Full	3		do	do	2.9	46.3	22.5	23.8	51
19		do	do	do	Aug. 3, 1940	Restricted	3		Green	do	1.8	45.3	26.5	18.8	42
20		do	do	do	Sept. 5, 1940	Full	3		Partly brown	do	2.0	44.0	20.8	23.2	53
21		do	do	do	Sept. 11, 1940	Restricted	3		Turning	do	2.1	48.9	25.8	23.1	47
22		do	do	do	do	do	3		do	do	2.2	48.5	25.5	23.0	47
23		do	do	do	Sept. 18, 1940	do	3		do	do	1.9	46.9	23.3	23.6	50

See footnotes at end of table.

TABLE 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)—Continued

Species and sample No. [1]	Source: State	Source: County	Source: Locality [2]	Source: Stand [3]	Date collected	Description: Exposure to sunlight	Description: Height of plant	Description: Sex [4]	Description: Color of leaves when collected	Description: Condition of cured sample	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive [5]
							Feet				*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina L.:															
24a	New Jersey.	Ocean	Whiting	Clump	Oct. 17, 1941	Restricted	4	Male	Green	Good	2.3	47.3	22.8	24.5	52
24b		do	do	do	Aug. 2, 1943	do	4	do	do	do	1.3	50.1	19.2	30.9	62
25		Atlantic	Absecon	District	do	Full			do	do	2.0	43.1	19.3	23.8	55
26		Cape May	Seaville	do	do	do			do	do	1.9	42.6	18.6	24.0	56
27		Gloucester	Gibbstown	Clump	Oct. 15, 1941	do	7	Male	do	do	1.2	38.3	20.2	18.1	47
28		Salem	Deepwater	do	Oct. 14, 1941	Restricted	4		do	do	2.1	40.9	18.2	22.7	56
29		do	do	do	Aug. 2, 1943	Full	3		do	do	1.5	49.0	18.5	30.5	62
30a		do	do	do	Oct. 14, 1941	do	6		do	do	.9	34.5	21.6	12.9	37
30b		do	do	do	Aug. 2, 1943	do	6		do	do	1.5	44.8	20.0	24.8	55
31a		do	do	do	Oct. 7, 1941	do	6	Male	do	do	2.4	43.4	19.7	23.6	54
31b		do	do	do	Aug. 2, 1943	do	6	do	do	do	1.2	40.6	20.4	20.2	50
32a		do	Salem	do	Oct. 14, 1941	Restricted	4	Female	do	do	1.1	42.5	18.0	24.5	58
32b		do	do	do	Aug. 2, 1943	do	4	do	do	do	2.1	42.2	19.0	23.2	55
33		do	Alloway	do	Oct. 15, 1941	do	5	do	do	do	1.4	41.2	19.8	21.4	52
34		do	do	do	Aug. 2, 1943	do			do	do	1.1	50.6	20.4	30.2	60
35a		do	Cohansey	do	Oct. 16, 1941	Full	3		do	do	1.2	47.8	20.7	27.1	57
35b		do	do	do	Aug. 2, 1943	do	3		do	do	1.3	50.4	20.9	29.5	59
36		do	Canton	do	Oct. 16, 1941	do	5		do	do	1.4	38.4	21.8	16.6	43
37		Cumberland	Roadstown	do	do	do	5	Male	do	do	1.7	42.4	23.0	19.4	46
38		do	Mauricetown	do	Aug. 2, 1943	Restricted	20		do	do	1.5	51.0	20.3	30.7	60
39		do	do	do	do	do	5		do	do	1.7	51.2	19.2	32.0	63
40	Pennsylvania.	Fulton	Waterfall	do	July 13, 1943	Full	4		do	Fair	1.3	51.3	19.4	31.9	62
41		Bedford	Everett	do	July 15, 1943	Restricted	4		do	Good	1.0	48.9	22.3	26.6	54

42		Cecil	Elk Neck	do	Aug. 21, 1941					Fair	1.3	44.2	18.8	25.4	57
43		Carroll	Westminster	do	Sept. 12, 1940	Restricted	3		Turning	Good	2.2	48.5	21.4	27.1	56
44		Frederick	Thurmont	do	Sept. 10, 1940	do	3		do	do	1.2	47.8	19.5	28.3	59
45		Montgomery	Potomac	do	July 11, 1938	do			do	do	1.5	53.1	20.5	32.6	61
46		Prince Georges.	Beltsville	do	Aug. 14, 1942	Full	5	Male	Green	do	1.3	49.4	16.4	33.0	67
47		do	do	do	do	do	5	do	do	do	1.0	53.3	15.8	37.5	70
48		do	do	do	do	Restricted	3	do	Turning	do	1.8	48.7	17.5	31.2	64
49		do	do	do	do	Full	4	do	Green	do	1.2	45.1	19.2	25.9	57
50		do	do	do	do	do	2	do	Turning	do	1.8	50.0	16.0	34.0	68
51		do	do	do	do	do	3	do	Partly red	do	3.2	54.5	18.2	36.3	67
52		do	do	do	do	do	3	do	do	do	2.0	51.1	19.5	31.6	62
53		do	do	do	do	do	3	Female	Green	do	1.9	45.4	18.2	27.2	60
54		do	do	do	do	do	4	do	do	do	1.6	46.7	18.3	28.4	61
55		do	do	do	do	do		do	do	do	1.6	48.9	18.2	30.7	63
56		do	do	do	do	do	2	do		do	1.8	51.3	19.0	32.3	63
57		do	do	do	do	do	3	do	Turning	do	2.0	50.3	18.4	31.9	63
58		do	do	do	do	do	5	do	do	do	1.6	47.8	22.5	25.3	53
59		do	do	do	do	do	3	do	do	do	1.9	46.7	18.5	28.2	60
60		do	do	do	do	Restricted	5	do	do	do	1.7	44.2	20.6	23.6	53
61		do	do	do	Aug. 15, 1941	Full	4	Male	Green	do	1.8	52.9	20.3	32.6	62
62		do	do	do	do	do	4	Female	do	do	1.3	44.7	18.1	26.6	60
63a		Charles	Wicomico	do	Sept. 12, 1936	do	4		do	do	2.3	51.6	20.8	30.8	60
63b	Maryland	do	do	do	May 31, 1937	do	4		do	do	1.3	59.4	21.7	37.7	63
63c		do	do	do	June 12, 1937	do	4		do	do	1.2	52.7	20.0	32.7	62
63d		do	do	do	June 19, 1937	do	4		do	do	1.1	54.8	19.5	35.3	64
63e		do	do	do	June 30, 1937	do	4		do	do	1.2	55.6	18.8	36.8	66
63f		do	do	do	July 6, 1937	do	4		do	do	1.2	54.2	17.9	36.3	67
63g		do	do	do	July 15, 1937	do	4		do	do	1.3	53.7	18.2	35.5	66
63h		do	do	do	July 28, 1937	do	4		do	do	1.3	53.4	20.4	33.0	62
63i		do	do	do	Aug. 22, 1937	do	4		do	do	1.4	50.4	19.1	31.3	62
63k		do	do	do	Sept. 1, 1937	do	4		do	do	1.1	50.8	20.9	29.9	59
63l		do	do	do	Sept. 12, 1937	do	4		do	do	1.8	52.3	22.8	29.5	56
63m		do	do	do	Sept. 25, 1937	do	4		Turning	do	1.7	53.5	22.7	30.8	58
63n		do	do	do	Oct. 9, 1937	do	4		do	do	1.6	53.1	23.6	29.5	56
63p		do	do	do	do	do	4		Green	do		55.3	27.1	28.2	51
63q		do	do	do	May 22, 1938	do	4		do	do	1.7	54.3	20.3	34.0	63
64		do	do	do	Oct. 9, 1937	do	3		Red	do	3.1	52.6	18.6	34.0	65
65a		do	do	do	do	do	4		do	do	2.8	63.3	18.2	45.1	71
65b		do	do	do	June 27, 1938	do	4		Green	do	1.3	61.1	18.1	43.0	70
65c		do	do	do	Aug. 3, 1938	do	4		do	do	1.6	62.5	20.6	41.9	66
66		do	do	do	July 28, 1937	Restricted	4		do	do	1.0	44.3	23.0	21.2	48
67		do	do	do	do	do	5		do	do	1.3	49.4	21.2	28.2	57
68		do	do	do	do	do	2		do	do	1.5	52.4	21.3	31.1	59
69a		do	do	do	do	Full	2		do	do	1.4	58.7	19.3	39.4	67
69b		do	do	do	June 27, 1938	do	2		do	do	1.3	58.3	18.0	40.3	69
69c		do	do	do	July 17, 1938	do	2		do	do	5.7	58.7	18.6	40.1	68
70		do	do	Field	July 28, 1937	do			do	do	1.4	53.8	18.9	34.9	65

See footnotes at end of table.

TABLE 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)—Continued

Species and sample No.[1]	Source: State	Source: County	Source: Locality[2]	Source: Stand[3]	Date collected	Description: Exposure to sunlight	Description: Height of plant	Description: Sex[4]	Description: Color of leaves when collected	Description: Condition of cured sample	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive[5]
							Feet				*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina L.:															
71a		Fairfax	Great Falls	Clump	June 29, 1939	Full	2		Green	Good	2.4	50.1	18.8	31.3	62
71b		do	do	do	Aug. 18, 1939	do	2		do	do	2.4	45.1	16.4	28.7	64
71c		do	do	do	June 26, 1940	do	2		do	do	1.1	50.4	21.8	28.6	57
71d		do	do	do	Sept. 5, 1940	do	2			Fair	1.5	42.5	18.1	24.4	57
72a		do	Centreville	do	June 26, 1939	do	3		Green	Good	2.9	50.8	19.9	30.9	61
72b		do	do	do	Aug. 17, 1939	do	3		do	do	1.8	54.1	19.3	34.8	64
72c		do	do	do	June 26, 1940	do	3		do	do	1.1	57.1	21.1	36.0	63
72d		do	do	do	Sept. 5, 1940	do	3			do	2.3	47.7	15.0	32.7	69
73		do	do	do	Aug. 6, 1942	do	3	Female	Green	Fair	8.1	46.7	18.2	28.5	61
74a		Fauquier	New Baltimore.	do	June 26, 1939	do	5		do	Good	1.7	56.9	18.1	38.8	68
74b		do	do	do	Aug. 17, 1939	do	5		Turning	do	2.2	55.6	19.8	35.8	64
74c		do	do	do	June 26, 1940	do	5		Green	do	2.0	41.7	21.7	20.0	48
74d		do	do	do	Sept. 5, 1940	do	5			Fair	2.1	51.5	17.7	33.8	66
75a		Caroline	Bowling Green	do	June 26, 1939	do	5		Green	Good	1.9	54.9	20.3	34.6	63
75b		do	do	do	Aug. 16, 1939	do	5		Turning	do	2.3	52.1	17.9	34.2	66
75c		do	do	do	June 26, 1940	do	5		Green	do	1.7	56.7	23.8	32.9	58
75d		do	do	do	Sept. 5, 1940	do	5			do	2.0	52.5	18.4	34.1	65
76		do	do	do	Aug. 6, 1942	do	4	Male	Green	Fair	1.1	44.8	16.2	28.6	64
77		do	do	do	do	do	4	do	do	do	2.1	47.6	15.0	32.6	68
78		do	do	do	do	do	4	Bisexual	do	do	1.3	47.4	15.5	31.9	67
79a		Culpeper	Culpeper	do	June 27, 1939	do	7		do	Good	1.7	52.2	20.2	32.0	61
79b		do	do	do	Aug. 17, 1939	do	7		do	do	2.6	50.2	20.1	30.1	60
79c		do	do	do	June 26, 1940	do	7		do	do	1.1	53.2	21.2	32.0	60
79d		do	do	do	Sept. 5, 1940	do	7			Fair	2.2	47.5	17.2	30.3	64
80		do	do	do	Aug. 6, 1942	do	4	Male	Turning	Good	1.6	49.6	15.0	34.6	70
81		do	do	do	do	do	3	do	do	Fair	1.5	44.3	17.3	27.0	61
82		do	do	do	do	do	4	Female	do	Good	2.4	46.4	14.0	32.4	70
83		Orange	Gordonsville	do	do	do	4	Male	Green	Fair	1.8	48.2	16.5	31.7	66
84		do	do	do	do	do	4	Female	Turning	do	2.2	46.8	14.1	32.7	70
85a		Fluvanna	Carysbrook	do	June 26, 1939	Restricted	10		Green	Good	2.8	56.8	20.1	36.7	65
85b		do	do	do	Aug. 17, 1939	do	10		do	do	1.9	48.3	18.8	29.5	61
85c		do	do	do	June 26, 1940	do	10		do	do	1.4	53.6	19.4	34.2	64

85d		do	do	do	Sept. 5, 1940	do	10			do	1.3	50.6	17.4	33.2	66
86		do	do	Single plant	Aug. 6, 1942	do	3	Female	Green	Fair	1.7	50.8	14.7	36.1	71
87a		Buckingham	Dillwyn	Clump	June 27, 1939	Full	3		do	Good	1.8	57.8	19.0	38.8	67
87b		do	do	do	Aug. 17, 1939	do	3		Turning	do	2.7	56.3	18.5	37.8	67
87c		do	do	do	June 26, 1940	do	3		Green	do	1.6	60.8	18.4	42.4	70
87d		do	do	do	Sept. 5, 1940	do	3			do	2.7	52.0	17.8	34.2	66
88	Virginia	do	do	do	Aug. 6, 1942	do	3	Female	Green	Fair	2.6	50.6	14.9	35.7	71
89		do	do	do	do	do	8	do	Turning	do	2.3	49.7	15.9	33.8	68
90		do	do	do	do	Restricted	6	Male	Green	do	1.7	48.9	17.4	31.5	64
91		do	do	do	do	Full	4	do	Turning	do	2.3	54.9	15.6	39.3	72
92		do	do	Single plant	do	Restricted	8	Female	do	do	1.8	51.4	16.3	35.1	68
93		Cumberland	Cumberland	District	Aug. 12, 1941				Green	Good	1.5	49.7	21.3	28.4	57
94a		Prince Edward.	Farmville	Clump	June 27, 1939	Full	5		do	do	2.2	59.3	20.5	38.8	65
94b		do	do	do	Aug. 16, 1939	do	5		do	do	2.4	53.6	19.4	34.2	64
94c		do	do	do	June 26, 1940	do	5		do	do	1.5	57.9	19.9	38.0	66
94d		do	do	do	Sept. 5, 1940	do	5			do	2.2	55.1	19.0	36.1	66
95		do	do	do	Aug. 6, 1942	Restricted	6	Male	Green	do	1.9	56.5	18.4	38.1	67
96		do	do	do	do	do	6	do	do	do	1.9	52.7	17.1	35.6	68
97a		Dinwiddie	Addison	do	June 27, 1939	Full	4		do	do	1.8	55.2	19.6	35.6	64
97b		do	do	do	Aug. 16, 1939	do	4		Turning	do	2.5	50.8	19.9	30.9	61
97c		do	do	do	June 26, 1940	do	4		Green		1.3	59.3	22.3	37.0	62
97d		do	do	do	Sept. 5, 1940	do	4			Fair	2.5	46.3	17.5	28.8	62
98a		do	Ford	do	June 27, 1939	do	3		Green	Good	1.8	53.1	19.7	33.4	63
98b		do	do	do	Aug. 16, 1939	do	3		do	do	2.3	52.1	19.2	32.9	63
98c		do	do	do	June 26, 1940	do	3		do	do	1.8	56.6	20.7	35.9	63
98d		do	do	do	Sept. 5, 1940	do	3			do	1.7	49.2	18.6	30.6	62
99a		Lunenburg	Lunenburg	do	June 27, 1939	do	12		Green	do	1.7	50.6	19.9	30.7	61
99b		do	do	do	Aug. 16, 1939	do	12		do	do	3.0	50.9	19.8	31.1	61
99c		do	do	do	June 26, 1940	do	12		do	do	1.2	52.7	21.2	31.5	60
99d		do	do	do	Sept. 5, 1940	do	12			Fair	1.3	45.0	16.0	29.0	64
100		do	do	Single plant	Aug. 6, 1942	Restricted	20	Male	Green	do	1.5	52.8	16.5	36.3	69
101		do	do	do	do	do	20	Female	do	Bad	1.7	45.8	17.0	28.8	63
102		do	do	do	do	do	20	do	do	Good	1.3	44.4	15.5	28.9	65
103		Norfolk	Wallaceton	District	June 27, 1942	Full	3		do	do	2.0	39.7	17.1	22.6	57
104		Isle of Wight	Windsor	do	do	do	2		do	do	1.6	51.8	18.0	33.8	65
105		Halifax	Halifax	Single plant	Aug. 6, 1942	Restricted	10	Male	do	do	1.8	52.2	18.6	33.6	64
106		do	do	do	do	do	10	Female	do	Fair	1.8	50.1	19.0	31.1	62
107		do	do	Clump	do	Full	5	Male	do	do	2.0	50.0	15.7	34.3	69
108		do	do	do	do	do	5	Female	do	do	2.0	46.0	15.8	30.2	66
109		do	do	do	do	Restricted	6	Male	do	do	2.0	47.5	13.8	33.7	71
110		do	do	do	do	do	6	Female	do	do	1.8	51.8	16.4	35.4	68
111		do	do	do	do	Full	5	Male	Turning	do	1.3	53.1	16.7	36.4	69
112		do	do	do	do	do	7	Female	Green	do	1.7	48.7	16.5	32.2	66
113		do	do	do	do	do	7	do	do	do	1.6	52.8	16.4	36.4	69
114		Bland	Bastian	do	Aug. 28, 1940	Restricted	4		do	do	1.4	41.8	15.9	25.9	62
115		Washington	Abingdon	do	Aug. 27, 1940	Full			Turning	Bad	1.4	42.2	17.8	24.4	58

See footnotes at end of table.

TABLE 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)—Continued

Species and sample No.[1]	Source: State	Source: County	Source: Locality[2]	Source: Stand[3]	Date collected	Description: Exposure to sunlight	Description: Height of plant	Description: Sex[4]	Description: Color of leaves when collected	Description: Condition of cured sample	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive[5]
							Feet				*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina L.:															
116	North Carolina	Beaufort	Washington	Clump	June 27, 1942	Restricted	3		Green	Good	1.2	41.7	16.5	25.2	60
117	North Carolina	Rockingham	Reidsville	do	Aug. 19, 1940	do	3		do	do	1.5	55.2	16.8	38.4	70
118	North Carolina	Guilford	Greensboro	do	do	Full	3		do	do	2.0	55.1	19.6	35.5	64
119	North Carolina	Randolph	Liberty	do	do	do	3		do	Fair	3.0	56.6	18.4	38.2	67
120	North Carolina	Lee	Sanford	do	do	Restricted	2		do	Good	2.0	48.7	19.2	29.5	61
121	North Carolina	Scotland	Laurinburg	do	do	do	2		Turning	do	4.2	43.9	17.3	26.6	61
122	North Carolina	do	Laurel Hill	do	do	do	4		Green	do	3.2	42.9	16.0	26.9	63
123	North Carolina	Mecklenburg	Charlotte	do	Aug. 20, 1940	Full	4		do	do	2.8	46.5	15.4	31.1	67
124	North Carolina	Madison	Hot Springs	do	do	Restricted			do	Fair	1.7	51.5	18.9	32.6	63
125	North Carolina	Swain	Bryson City	do	Aug. 21, 1940	Full			do	Bad	2.3	50.3	18.6	31.7	63
126	Kentucky	Simpson	Franklin	do	Aug. 25, 1940	do			Turning	do	2.0	50.5	17.5	33.0	65
127	Kentucky	Todd	Elkton	do	do	do			Green	do	1.4	50.4	18.8	31.6	63
128	Kentucky	Christian	Edgoten	do	do	Restricted	2		Turning	Good	1.5	55.6	20.4	35.2	63
129	Tennessee	Sullivan	Bristol	do	Sept. 28, 1938	Full			Red	Good	1.8	49.3	20.9	28.4	58
130	Tennessee	do	do	do	do	do			Partly red	do	1.8	57.1	25.3	31.8	56
131	Tennessee	do	do	do	do	do			Red	do	2.2	55.0	21.8	33.2	60
132	Tennessee	do	do	do	do	do	3		Turning	do	2.1	51.9	23.5	28.4	55
133	Tennessee	Hawkins	Rogersville	do	Aug. 27, 1940	do	4		Green	Fair	1.5	52.5	18.8	33.7	64
134	Tennessee	Roane	Kingston	do	Aug. 26, 1940	do	4		Turning	Bad	1.7	48.2	18.1	30.1	62
135	Tennessee	Cumberland	Pleasant Hill	do	do	do	4		Green	do	1.5	43.9	15.7	28.2	64
136	Tennessee	Warren	McMinnville	do	do	do	4		do	do	1.9	52.6	18.2	34.4	65
137	Tennessee	Cannon	Woodbury	do	do	do			do	Fair	1.6	56.1	22.9	33.2	59
138	Tennessee	Davidson	Nashville	do	Aug. 25, 1940	do			do	Bad	.7	49.4	27.3	22.1	45
139	Tennessee	Cheatham	Kingston Springs	do	Aug. 24, 1940	Restricted			Turning	Fair	1.6	50.2	19.4	30.8	61
140	Tennessee	Benton	Camden	do	do	Full	3		Green	Good	2.8	59.8	20.2	39.6	66
141	Tennessee	Weakley	Gleason	do	do	do	4		Turning	Poor	2.5	53.8	18.7	35.1	65
142	Tennessee	Carroll	McKenzie	do	do	do	4		Green	Good	1.9	58.1	19.4	38.7	67
143	Tennessee	Hamilton	Chattanooga	do	Aug. 23, 1940	do			do	do	3.0	54.2	18.2	36.0	66
144	Tennessee	Marion	Jasper	do	do	Restricted	12		do	Fair	1.6	46.3	17.7	28.6	62
145	Tennessee	Grundy	Monteagle	do	do	Full	2		do	Poor	2.0	54.4	19.5	34.9	64
146	Tennessee	Lincoln	Fayetteville	do	do	do	3		do	Fair	2.3	53.8	18.8	35.0	65
147	Tennessee	Lawrence	Lawrenceburg	do	do	Restricted	3		do	Good	2.8	56.8	19.7	37.1	65
148	Tennessee	Hardin	Savannah	do	do	Full	3		do	Bad	2.0	50.4	19.9	30.5	61

149	South Carolina.	Greenville	Greer	do	Aug. 20, 1940	do	4		do	Good	2.3	55.7	20.8	34.9	63
150		do	Travelers Rest	do	do	do	6		do	do	2.4	60.0	20.8	39.2	65
151 [6]		Richland	Columbia	do	Aug. 15, 1940	Restricted	6		do	do	3.6	42.4	17.4	25.0	59
152		Rabun	Clayton	do	Aug. 21, 1940	Full	3		do	Fair	2.3	54.1	19.2	34.9	65
153		Habersham	Clarkesville	do	do	do	3		do	do	1.6	51.2	19.3	31.9	62
154		Hall	Oakwood	do	Aug. 22, 1940	do	2		do	Good	1.8	45.3	18.6	26.7	59
155		Gwinnett	Norcross	do	do	Restricted	2		do	do	2.2	53.8	18.5	35.3	66
156		Bartow	Cartersville	do	do	Full	5		Turning	Poor	2.1	55.4	20.2	35.2	64
157		Gordon	Calhoun	do	do	do	3		Green	Good	2.5	56.6	17.5	39.1	69
158		Catoosa	Ringgold	do	do	do			do	do	2.5	57.4	19.6	37.8	66
159	Georgia	Richmond	Augusta	do	Aug. 15, 1940	Restricted	1				3.6	42.1	18.6	23.5	56
160		DeKalb	Stone Mountain.	do	Aug. 17, 1940	do			Green	Good	2.2	57.0	20.6	36.4	64
161 [6]		Spaulding	Griffin	do	Aug. 16, 1940	Full	3		do	do	3.6	39.6	20.6	19.0	48
162		Sumter	Americus	District	Aug. 23, 1942	do			do	do	3.1	41.3	17.6	23.7	57
163		Ben Hill	Fitzgerald	Clump	July 27, 1942	do	5		do	do	2.8	43.6	18.2	25.4	58
164		Berrien	Alapaha	do	Sept. 18, 1943		3		Turning	do	1.9	44.6	19.1	25.5	57
165	Alabama	Lowndes	Benton	do	Aug. 19, 1940	Full			do	do	2.7	55.7	21.6	34.1	61
166 [6]		Okaloosa	Valparaiso	do	May 17, 1939	do	4		Green	do	1.3	58.2	19.3	38.9	67
167 [6]		do	do	do	Aug. 12, 1940	do	3		do	do	1.3	51.4	16.2	35.2	68
168 [6]	Florida	do	do	do	do	do	3		do	do	3.0	50.7	17.9	32.8	65
169 [6]		do	do	do	do	do	3		do	do	1.7	55.2	16.7	38.5	70
170		do	Crestview	District	Aug. 21, 1942	do			Turning	do	2.0	49.6	17.7	31.9	64
171		Lauderdale	Lauderdale	Clump	Aug. 19, 1940	Restricted	2		Green	do	2.4	57.8	22.4	35.4	61
172	Mississippi	Scott	Forest	do	Aug. 20, 1940	Full			Turning	do	3.3	62.3	21.9	40.4	65
173		Hinds	Bolton	do	do	do	5		Green	do	2.2	54.4	23.8	30.6	56
174		Ouachita	Monroe	do	Aug. 21, 1940	Restricted			Turning	do	2.1	56.5	21.7	34.8	62
175		Webster	Minden	do	do	Full	3		do	do	2.4	57.5	22.0	35.5	62
176	Louisiana	Beauregard	Singer	do	Aug. 9, 1940	Restricted			do	do	2.0	54.9	17.3	37.6	68
177		do	Merryville	do	Aug. 8, 1940	do	4		do	do	2.1	53.2	17.7	35.5	67
178		Jasper	Jasper	do	Aug. 9, 1940	do	8		do	do	1.8	57.2	17.4	39.8	70
179		Harrison	Harleton	do	June 18, 1938	Full			do	do	1.8	59.1	20.8	38.3	65
180		Leon	Oakwood	do	June 15, 1938	do			Green	do	1.5	51.7	21.4	30.3	59
181	Texas	do	Leona	do	June 7, 1939	Restricted			do	do	1.9	53.4	18.5	34.9	65
182		Brazos	Wellborn	do	June 22, 1939	do			do	do	2.0	54.5	19.4	35.1	64
183		Milam	Milano	do	June 23, 1939	do	5		do	do	2.2	58.5	19.6	38.9	67
184		Wise	Alvord	do	Aug. 14, 1939	Full	6		Turning	do	2.0	53.5	18.6	34.9	65
185		Van Buren	Keosauqua	Clone	Sept. 8, 1939	Restricted	12	Male	Green	do	2.1	51.4	19.8	31.6	61
186		do	do	do	Sept. 27, 1939	do	4	do	do	do	2.0	53.7	23.3	30.4	57
187		do	do	do	July 27, 1940	do	12	do	do	do	1.5	57.6	19.4	38.2	66
188		do	do	do	do	do	12	do	do	do	1.0	55.1	19.9	35.2	64
189		do	do	do	Aug. 17, 1940	Full	12	do	do	do	2.4	53.7	21.5	32.2	60
190	Iowa	do	do	do	Sept. 5, 1940	do	12	do	Partly red	do	1.9	54.9	20.1	34.8	63
191		do	do	do	Sept. 21, 1940	do	12	do	Turning	do	1.7	51.1	20.3	30.8	60
192		do	do	do	June 13, 1941	do	12	do	Green	do	1.2	57.5	18.9	38.6	67
193		do	do	do	June 30, 1941	do	12	do	do	do	1.1	58.9	19.2	39.6	67
194		do	do	do	July 21, 1941	do	12	do	do	do	1.9	56.6	21.5	35.1	62
195		do	do	do	Aug. 12, 1941	do	12	do	do	do	1.5	54.8	21.0	33.8	62

See footnotes at end of table.

TABLE 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)—Continued

Species and sample No. [1]	Source: State	Source: County	Source: Locality [2]	Source: Stand [3]	Date collected	Description: Exposure to sunlight	Description: Height of plant	Description: Sex [4]	Description: Color of leaves when collected	Description: Condition of cured sample	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive [5]
							Feet				*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. glabra L.:															
196a	New York	Ontario	Geneva	Clump	June 27, 1939	Full	3		Green	Good	2.2	48.4	22.5	25.9	54
196b		do	do	do	Aug. 9, 1939	do	3		do	do	2.4	46.9	23.4	23.5	50
196c		do	do	do	Sept. 11, 1940	do	3		Turning	Fair	2.3	44.2	19.5	24.7	56
197		Seneca	Interlaken	do	do	do	3		Green	do	2.1	40.7	19.7	21.0	52
198		Yates	Rock Stream	do	Sept. 10, 1940	do	2		Turning	Good	3.2	53.6	22.7	30.9	58
199		Tioga	Owego	do	Sept. 12, 1940	do	4		do	do	1.7	39.6	19.5	20.1	51
200	Pennsylvania	Luzerne	Huntington Mills.	do	do	do	3		do	do	2.2	52.6	23.4	29.2	56
201		Montour	Danville	do	do	do	4		Green	Fair	2.1	47.9	20.3	27.6	58
202		Lycoming	Williamsport	do	Sept. 10, 1940	do	2		do	Good	1.6	42.7	19.0	23.7	56
203		Union	Winfield	do	do	Restricted	3		do	do	1.5	41.0	18.2	22.8	56
204		Perry	Amity Hall	do	do	Full	4		do	Fair	1.7	38.2	18.6	19.6	51
205a		Montgomery	Wyndmoor	do	Sept. 22, 1942	do	3	Male	do	Good	2.0	45.5	22.5	23.0	51
205b		do	do	do	July 6, 1943	do	3	do	do	do	1.4	47.5	20.5	27.0	57
205c [7]		do	do	do	Oct. 22, 1943	do	3	do	Red	do	2.7	47.2	19.4	27.8	59
206a [7]		do	do	Field	July 6, 1943	do	4		Green	do	.9	47.3	19.9	27.4	58
206b [7]			do	do	Oct. 22, 1943	do	4		Red	do	2.4	52.3	19.2	33.1	63
207a [7]		do	do	Clump	July 16, 1943	do	6	Female	Green	do	1.3	43.3	24.2	19.1	44
207b [7]		do	do	do	Oct. 22, 1943	do	6	do	Red	do	2.7	44.0	19.6	24.4	55
208a [7]		do	do	Field	July 6, 1943	do	4	Male	Green	do	1.5	46.2	22.4	23.8	52
208b [7]		do	do	do	Aug. 16, 1943	do	4	do	do	do	1.2	44.8	21.9	22.9	51
209a [7]		do	do	Clump	July 13, 1943	do	4	Female	do	do	1.7	44.0	20.5	23.5	53
209b [7]		do	do	do	Aug. 16, 1943	do	4	do	do	do	1.5	44.3	22.6	21.7	49
210		York	Spring Grove	do	Sept. 12, 1940	Restricted	4		Turning	do	1.6	37.0	20.0	17.0	46
211		Franklin	Greencastle	do	June 22, 1943	Full			Green	do	1.6	50.9	19.1	31.8	62
212		do	Dry Run	Field	July 6, 1943	do	9		do	Fair	1.9	45.0	19.2	25.8	57
213		Huntingdon	Burnt Cabins	do	do	do	4		do	Good	1.3	50.5	16.4	34.1	68
214		Fulton	Waterfall	do	July 13, 1943	do	4		do	do	1.6	46.0	18.0	28.0	61
215		do	Hustontown	Clump	July 6, 1943	do	6		do	do	1.8	46.2	17.5	28.7	62
216		do	Wells Tannery	do	July 13, 1943	Restricted	10		do	do	1.8	44.2	18.6	25.6	58
217		Bedford	Breezewood	do	July 15, 1943	Full	6		do	do	1.3	38.7	20.4	18.3	47
218		do	Everett	do	do	do	6		do	do	1.5	46.9	21.6	25.3	54
219 [7]	New Jersey	Salem	Deepwater	do	Aug. 2, 1943	do	3		do	do	1.3	49.3	21.4	27.9	57
220 [7]		do	Quinton	do	do	do	3		do	do	1.4	46.5	22.9	23.6	51

221		Baltimore	Kingsville	Clump	Aug. 21, 1941					Good	1.5	46.1	21.8	24.3	53
222		Carroll	Westminster	do	Sept. 12, 1940	Restricted	4		Turning	do	1.7	42.7	21.5	21.2	50
223		Frederick	Thurmont	do	Sept. 10, 1940	do	4		do	do	1.2	41.5	16.6	24.9	60
224		Washington	Leitersburg	Field	June 22, 1943	do			Green	do	1.3	45.7	20.3	25.4	56
225		do	Cearfoss	do	do	do			do	do	1.0	48.2	20.0	28.2	59
226		do	Hagerstown	do	do	Full			do	do	1.4	50.0	19.2	30.8	62
227		do	Williamsport	do	June 21, 1943	Restricted			do	do	1.6	46.4	19.9	26.5	57
228		do	do	do	do	Full			do	do	1.2	48.6	20.4	28.2	58
229 [7]		do	Sharpsburg	Clump	June 19, 1942	do	4		do	do	1.4	41.1	17.7	23.4	57
230		do	Big Spring	Field	June 21, 1943	Restricted			do	do	1.6	48.2	20.4	27.8	58
231		do	Indian Springs	do	do	Full			do	do	1.6	52.5	18.3	34.2	65
232		do	do	do	do	do			do	do	1.6	50.9	20.1	30.8	61
233		do	Hancock	do	Sept. 26, 1942	do	7		Red	do	1.9	45.7	19.3	26.4	58
234		do	do	do	do	do	7	Female	do	do	2.3	50.9	18.9	32.0	63
235a		do	do	Clump	June 21, 1943	do	6	Male	Green	do	1.7	45.7	19.3	26.4	58
235b		do	do	do	July 28, 1943	do	6	do	do	do	1.6	46.0	20.8	25.2	55
235c		do	do	do	Aug. 31, 1943	do	6	do	Turning	do	1.9	44.2	20.7	23.5	53
236a		do	do	do	June 21, 1943	do	6	Female	Green	do	1.4	52.4	18.4	34.0	65
236b		do	do	do	July 28, 1943	do	6	do	do	do	1.3	54.0	18.9	35.1	65
236c		do	do	do	Aug. 31, 1943	do	6	do	Partly red	do	1.5	51.3	20.0	31.3	61
237a		do	do	do	June 21, 1943	do	5	do	Green	do	1.3	51.4	20.4	31.0	60
237b		do	do	do	July 28, 1943	do	5	do	do	do	1.4	49.7	21.2	28.5	57
237c		do	do	do	Aug. 31, 1943	do	5	do	Partly red	do	2.0	46.1	21.7	24.4	53
238a		do	do	do	June 21, 1943	do	8	do	Green	do	1.4	50.3	20.5	29.8	59
238b		do	do	do	July 28, 1943	do	8	do	do	do	1.7	47.3	21.4	25.9	55
238c	Maryland	do	do	do	Aug. 31, 1943	do	8	do	Partly red	do	1.8	46.9	21.5	25.4	54
239		do	do	Field	Sept. 26, 1942	do	5	Male	Turning	Fair	1.9	42.5	21.2	21.3	50
240		do	do	do	do	do	5	Female	Red	Good	2.5	51.2	19.6	31.6	62
241		do	do	do	do	do	6	Male	Green	do	1.5	43.3	20.2	23.1	53
242		do	do	do	do	do	4	Female	Partly red	do	1.9	43.6	20.7	22.9	53
243 [7]		Allegany	Flint Stone	Clump	June 19, 1942	do	3		Green	do	1.5	50.0	18.3	31.7	63
244 [7]		do	do	do	do	do	3		do	do	1.7	49.3	19.6	29.7	60
245 [7]		do	do	do	do	do	15		do	do	1.9	43.5	19.4	24.1	55
246		do	do	Field	July 13, 1942	do	3		do	do	1.7	49.4	19.7	29.7	60
247		do	do	do	July 20, 1942	do	4		do	do	2.3	47.8	17.7	30.1	63
248		do	do	do	do	do	5		do	do	1.6	45.6	18.0	27.6	61
249		do	do	do	do	do	3		do	do	1.9	42.4	17.2	25.2	59
250		do	do	do	do	do	4		do	do	1.6	52.6	18.9	33.7	64
251		do	do	do	do	do	3		do	do	1.8	48.4	18.8	29.6	61
252		do	do	do	do	do	4		do	do	1.7	48.2	19.2	29.0	60
253		do	do	do	Sept. 26, 1942	Restricted	4		Turning	do	1.5	42.1	19.7	22.4	53
254		do	Oldtown	do	July 20, 1942	Full	3		do	do	1.7	47.6	18.8	28.8	61
255		do	do	do	do	do	4		do	do	1.7	50.2	20.0	30.2	60
256		do	do	do	do	do	4		Green	do	1.9	52.1	19.3	32.8	63
257		do	do	do	do	do			do	do	2.1	48.6	20.3	28.3	58
258		do	do	do	do	do	4		do	do	1.7	47.2	19.8	27.4	58
259		do	Cumberland	do	do	do	3		do	do	2.2	46.8	17.4	29.4	63
260		do	do	do	do	do	4		do	do	2.1	50.3	19.0	31.3	62
261		do	Rawlings	do	do	do	4		do	do	1.9	49.8	17.5	32.3	65
262		Charles	Wicomico	Clump	June 19, 1937	Restricted	3		do	do	1.4	45.3	17.5	27.8	61
263		St. Marys	Budds Creek	do	July 15, 1938	do	4		do	do	1.4	44.0	18.4	25.6	58

See footnotes at end of table.

TABLE 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)—Continued

Species and sample No.[1]	Source: State	Source: County	Source: Locality[2]	Source: Stand[3]	Date collected	Description: Exposure to sunlight	Description: Height of plant	Description: Sex[4]	Description: Color of leaves when collected	Description: Condition of cured sample	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive[5]
							Feet				*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. glabra L.:															
264a	West Virginia	Jefferson	Bolivar	Clump	June 29, 1939	Restricted	4		Green	Good	2.0	50.7	19.9	30.8	61
264b		do	do	do	Aug. 18, 1939	do	4		do	do	1.8	48.9	19.4	29.5	60
264c		do	do	do	June 26, 1940	do	4		do	do	1.9	42.5	19.1	23.4	55
264d		do	do	do	Sept. 5, 1940	do	4			do	1.5	40.7	18.4	22.3	55
265[7]		Berkeley	Martinsburg	do	June 19, 1942	do	5		Green	do	1.9	44.3	17.9	26.4	60
266	Virginia	Fairfax	McLean	do	July 18, 1938	Full	3		do	do	1.4	42.7	18.3	24.4	57
267a		Loudoun	Bluemont	do	June 29, 1939	do	4		do	do	1.7	47.5	19.3	28.2	59
267b		do	do	do	Aug. 18, 1939	do	4		do	do	2.3	46.2	19.4	26.8	58
267c		do	do	do	June 26, 1940	do	4		do	do	1.5	51.7	20.2	31.5	61
267d		do	do	do	Sept. 5, 1940	do	4			Fair	1.3	45.5	17.3	28.2	62
268a		Fairfax	Centreville	do	June 26, 1939	do	3		Green	Good	2.0	46.4	20.0	26.4	57
268b		do	do	do	Aug. 17, 1939	do	3		Turning	do	2.1	47.6	19.7	27.9	59
268c		do	do	do	June 26, 1940	do	3		Green	do	1.3	53.1	21.3	31.8	60
268d		do	do	do	Sept. 5, 1940	do	3			Fair	1.9	48.5	18.3	30.2	62
269a		Fauquier	New Baltimore	do	June 26, 1939	do	4		Green	Good	2.0	47.6	18.2	29.4	62
269b		do	do	do	Aug. 17, 1939	do	4		do	do	2.2	44.6	20.0	24.6	55
269c		do	do	do	June 26, 1940	do	4		do	do	1.3	49.1	19.7	29.4	60
269d		do	do	do	Sept. 5, 1940	do	4			Fair	1.3	40.6	17.0	23.6	58
270a		Stafford	Berea	do	June 26, 1939	do	4		Green	Good	2.0	47.4	20.5	26.9	57
270b		do	do	do	Aug. 16, 1939	do	4		do	do	2.4	44.2	18.7	25.5	58
271a		Caroline	Bowling Green.	do	June 26, 1939	do	4		do	do	1.7	52.4	22.1	30.3	58
271b		do	do	do	Aug. 16, 1939	do	4		do	do	2.3	49.5	20.5	29.0	59
271c		do	do	do	June 26, 1940	do	4		do	do	2.3	53.8	22.4	31.4	58
271d		do	do	do	Sept. 5, 1940	do	4			Fair	1.7	44.7	16.9	27.8	62
272		do	do	Single plant.	Aug. 6, 1942	Restricted	15	Male	Green	Good	1.5	35.1	18.4	16.7	48
273		do	do	Clump	do	Full	2	Female	do	do	1.5	50.4	17.6	32.8	65
274a		Orange	Orange	do	June 27, 1939	do	7		do	do	2.0	46.5	20.0	26.5	57
274b		do	do	do	Aug. 17, 1939	do	7		do	do	2.1	42.3	19.9	22.4	53
274c		do	do	do	June 26, 1940	do	7		do	do	2.3	56.8	18.8	38.0	67
274d		do	do	do	Sept. 5, 1940	do	7			Fair	1.6	46.0	16.2	29.8	65
275		do	do	do	Aug. 6, 1942	do	6	Male	Green	do	2.1	49.8	16.7	33.1	66
276		do	do	do	do	do	6	Female	do	do	2.0	44.3	16.9	27.4	62
277a		Fluvanna	Carysbrook	do	June 27, 1939	Restricted	3		do	Good	1.8	54.0	20.7	33.3	62

277b		do	do	do	Aug. 17, 1939	do	3		Turning	do	2.3	47.5	21.6	25.9	55
277c		do	do	do	June 26, 1940	do	3		Green	do	1.5	46.2	20.1	26.1	56
277d		do	do	do	Sept. 5, 1940	do	3			Fair	2.4	47.0	17.5	29.5	63
278a		Buckingham.	Dillwyn	do	June 27, 1939	Full	4		Green	Good	2.3	41.3	21.4	19.9	48
278b		do	do	do	Aug. 17, 1939	do	4		Turning	do	2.2	39.4	18.5	20.9	53
278c		do	do	do	June 26, 1940	do	4		Green	do	1.4	46.7	17.1	29.6	63
278d		do	do	do	Sept. 5, 1940	do	4			do	1.8	45.9	16.8	29.1	63
279a		do	do	do	June 27, 1939	do	3		Green	do	2.0	45.2	20.9	24.3	54
279b		do	do	do	Aug. 17, 1939	do	3		Turning	do	2.7	48.9	19.2	29.7	61
297c		do	do	do	June 26, 1940	do	3		Green	do	1.8	53.4	19.6	33.8	63
279d		do	do	do	Sept. 5, 1940	do	3			do	2.5	49.0	17.0	32.0	65
280a		Prince Edward.	Farmville	do	June 27, 1939	Restricted	4		Green	do	2.3	50.3	19.2	31.1	62
280b		do	do	do	Aug. 16, 1939	do	4		Turning	do	1.9	44.0	19.7	24.3	55
280c		do	do	do	June 26, 1940	do	4		Green	do	1.4	46.2	18.7	27.5	60
280d		do	do	do	Sept. 5, 1940	do	4			do	2.6	45.7	20.8	24.9	54
281a		Lunenburg	Lunenburg	do	June 27, 1939	Full	4		Green	do	1.9	47.8	20.0	27.8	58
281b		do	do	do	Aug. 18, 1939	do	4		Turning	do	2.1	44.2	19.2	25.0	57
281c		do	do	do	June 26, 1940	do	4		Green	do	1.5	49.6	20.6	29.0	58
281d		do	do	do	Sept. 5, 1940	do	4			do	2.0	44.9	18.9	26.0	58
282		Bland	Rocky Gap	do	Aug. 28, 1940	do	4		Turning	Bad	.8	30.9	15.4	15.5	50
283		Wythe	Wytheville	do	do	do	6			Fair	1.3	41.8	17.7	24.1	58
284		Tazewell	Pounding Mill.	do	Aug. 27, 1940	do	4		Green	do	1.5	40.4	16.8	23.6	58
285		Washington	Abingdon	do	do	do			Turning	Bad	1.0	29.5	17.5	12.0	41
286		Rockingham	Ruffin	do	Aug. 19, 1940	Full	4		Green	Good	2.2	41.6	16.8	24.8	60
287		Randolph	Liberty	do	do	do	2		do	do	1.5	46.5	18.4	28.1	60
288	North Carolina.	Mecklenburg.	Charlotte	do	Aug. 20, 1940	do	4		Turning	do	1.8	46.1	17.1	29.0	63
289		Madison	Hot Springs	do	do	Restricted			do	do	1.3	52.7	19.3	33.4	63
290		Haywood	Hazelwood	do	Aug. 21, 1940	Full	5		Green	Poor	2.0	36.2	20.8	15.4	42
291		Swain	Bryson City	do	do	do	5		Turning	Fair	1.4	38.4	20.2	18.2	47
292		Warren	Bowling Green	do	Aug. 25, 1940	do	5		do	Bad	1.7	36.6	17.3	19.3	53
293	Kentucky.	Christian	Fairview	do	do	do			do	Poor	.8	31.8	14.3	17.5	55
294		do	Edgoten	do	do	do	3		do	Fair	2.1	33.3	17.5	15.8	47
295		Sullivan	Bristol	do	Sept. 28, 1938	do	3		Green	Good	1.8	47.8	20.6	27.2	57
296		do	do	do	do	do	3		Red	do	2.1	47.8	22.1	25.7	54
297		Knox	Blaine	do	Aug. 27, 1940	do			Turning	Poor	1.3	34.8	16.9	17.9	51
298		Roane	Kingston	do	Aug. 26, 1940	do	5		do	Good	1.7	40.6	18.5	22.1	54
299		Warren	McMinnville	do	do	do			do	Fair	1.5	39.6	18.3	21.3	54
300		Davidson	Nashville	do	Aug. 25, 1940	do	8		Green	do	1.0	33.5	18.2	15.3	46
301	Tennessee.	Cheatham	Kingston Springs.	do	Aug. 24, 1940	Restricted	12		Turning	Good	1.7	39.1	19.8	19.3	49
302		Benton	Camden	do	do	Full			do	Fair	1.7	38.1	19.7	18.4	48
303		Carroll	McKenzie	do	do	do	6		do	do	1.3	46.5	20.8	25.7	55
304		Hamilton	Chattanooga	do	Aug. 23, 1940	do	9		Green	Poor	1.0	29.5	18.5	11.0	37
305		Marion	Jasper	do	do	Restricted			do	do	1.5	36.1	19.1	17.0	47
306		Giles	Pulaski	do	do	Full	3		Turning	do	1.9	33.8	20.5	13.3	39

See footnotes at end of table.

TABLE 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)—Continued

Species and sample No. [1]	Source: State	Source: County	Source: Locality [2]	Source: Stand [3]	Date collected	Description: Exposure to sunlight	Description: Height of plant	Description: Sex [4]	Description: Color of leaves when collected	Description: Condition of cured sample	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive [5]
R. glabra L.:							*Feet*				*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
307	South Carolina.	Cherokee	Blacksburg	Clump	Aug. 20, 1940	Full	2		Turning	Good	2.8	46.7	19.3	27.4	59
308		Greenville	Greer	do	do	do	4		do	do	2.3	50.8	23.5	27.3	54
309		do	Tigerville	do	do	do	6		Green	do	1.8	37.8	22.9	14.9	39
310	Georgia	Hall	Oakwood	do	Aug. 22, 1940	do	3		Turning	do	1.4	46.0	20.2	25.8	56
311		Cobb	Smyrna	do	do	do	4		Green	do	1.6	40.7	19.6	21.1	52
312		Bartow	Cartersville	do	do	do	4		Turning	do	1.9	41.8	19.2	22.6	54
313		Baldwin	Milledgeville	do	Aug. 16, 1940	do	4		Green	do	1.8	48.4	22.4	26.0	54
314	Alabama	Lee	Auburn	do	Aug. 19, 1940	do	5		Turning	do	1.4	47.4	19.7	27.7	58
315		Marengo	Demopolis	do	do	Restricted			do	do	1.9	47.8	23.4	24.4	51
316	Texas	Jack	Jacksboro	do	July 9, 1940	do	8		Green	do	1.6	50.1	22.1	28.0	56
317		Walker	Huntsville	do	Aug. 8, 1940	do	8		Turning	do	1.9	43.8	18.5	25.3	58
318		Harrison	Harleton	do	June 18, 1938	Full			do	do	1.8	47.3	20.1	27.2	58
319		Smith	Gladewater	do	June 8, 1939	Restricted			Green	do	1.9	44.5	18.5	26.0	58
320		Robertson	Calvert	do	Aug. 14, 1939	do			Turning	do	2.2	49.6	18.4	31.2	63
321		Brazos	College Station.	do	June 22, 1939	do			Green	do	1.5	42.6	20.7	21.9	51
322		Milam	Milano	do	June 23, 1939	Full	3		do	do	2.2	45.3	19.7	26.6	57
323a		Davis	Floris	Clone	Aug. 1, 1939	do	5	Male	do	do	1.4	48.3	20.0	28.3	59
323b		do	do	do	Sept. 8, 1939	do	5	do	Partly red	do	1.6	44.8	17.8	27.0	60
323c		do	do	do	June 27, 1940	do	5	do	Green	Fair	1.5	52.5	20.1	32.4	62
323d		do	do	do	July 26, 1940	do	5	do	do	Good	1.4	46.9	20.5	26.4	56
323e		do	do	do	Aug. 21, 1940	do	5	do	Turning	do	1.5	45.4	21.1	24.3	54
323f		do	do	do	Sept. 11, 1940	do	5	do	Partly red	do	1.5	50.3	25.0	25.3	50
323g		do	do	do	June 12, 1941	do	5	do	Green	do	.9	50.9	19.4	31.5	62
323h		do	do	do	July 1, 1941	do	5	do	do	do	1.4	48.1	20.8	27.3	57
323i		do	do	do	July 21, 1941	do	5	do	do	do	1.3	45.8	20.8	25.0	55
323j		do	do	do	Aug. 12, 1941	do	5	do	do	do	1.8	45.7	21.9	23.8	52
323k		dl	do	do	Sept. 11, 1941	do	5	do	do	do	1.4	44.7	19.5	25.2	56
323l		do	do	do	June 18, 1943	do	5	do	do	Fair	1.5	51.5	20.8	30.7	60
324a		do	do	do	Sept. 5, 1939	do	5	Female	Red	Good	1.7	38.0	16.0	22.0	58
324b		do	do	do	June 27, 1940	do	5	do	Green	do	1.7	53.1	18.2	34.9	66
324c		do	do	do	Aug. 2, 1940	do	5	do	do	do	1.6	45.6	19.0	26.6	58
324d		do	do	do	Aug. 21, 1940	do	5	do	do	do	1.6	44.6	19.0	25.6	57
324e		do	do	do	May 26, 1941	do	5	do	do	do	1.7	47.3	21.7	25.6	54
324f		do	do	do	June 12, 1941	do	5	do	do	do	1.7	48.9	19.4	29.5	60

324g		do	do	do	July 1, 1941	do	5	do	do	do	1.4	49.2	19.7	29.5	60
324h		do	do	do	July 21, 1941	do	5	do	do	do	1.8	48.3	19.9	28.4	59
324i		do	do	do	Aug. 12, 1941	do	5	do	Turning	do	2.0	47.9	21.2	26.7	56
324j		do	do	do	Sept. 11, 1941	do	5	do	do	do	1.6	43.1	17.8	25.3	59
325a		do	do	do	Sept. 8, 1939	do	4	Bisexual	Green	Poor	2.1	43.7	17.4	26.3	60
325b		do	do	do	Sept. 21, 1940	do	4	do	do	Good	1.4	48.3	21.3	27.0	56
325c		do	do	do	May 26, 1941	do	4	do	do	do	1.4	42.2	21.2	21.0	50
325d		do	do	do	June 12, 1941	do	4	do	do	do	1.5	45.6	19.2	26.4	58
325e		do	do	do	July 1, 1941	do	4	do	do	do	1.4	48.2	19.6	28.6	59
325f		do	do	do	July 21, 1941	do	4	do	do	do	1.4	49.9	19.5	30.4	61
325g		do	do	do	Aug. 12, 1941	do	4	do	do	do	2.0	47.1	20.1	27.0	57
325h		do	do	do	Sept. 11, 1941	do	4	do	do	do	1.7	43.8	18.7	25.1	57
325i		do	do	do	June 10, 1942	do	4	do	do	do	1.3	43.8	18.4	25.4	58
325j		do	do	do	Aug. 2, 1943	do	4	do	do	do	1.7	41.1	17.5	23.6	57
326a		do	do	do	Sept. 6, 1939	do	5	Female	Red	do	1.4	40.5	16.0	24.5	60
326b		do	do	do	Aug. 5, 1940	do	6	do	Green	do	1.8	45.5	22.5	23.0	51
326c	Iowa	do	do	do	Aug. 21, 1940	do	6	do	Partly red	do	1.6	44.0	20.0	24.0	55
326d		do	do	do	May 26, 1941	do	6	do	Green	do	1.5	47.8	20.8	27.0	57
326e		do	do	do	June 12, 1941	do	6	do	do	do	1.5	49.7	20.8	28.9	58
326f		do	do	do	July 1, 1941	do	6	do	do	do	1.5	48.1	19.9	28.2	59
326g		do	do	do	July 21, 1941	do	6	do	do	do	2.5	49.5	20.8	28.7	58
326h		do	do	do	Aug. 12, 1941	do	6	do	do	do	1.2	48.0	20.4	27.6	58
326i		do	do	do	Sept. 11, 1941	do	6	do	do	do	1.7	43.9	19.7	24.2	55
327a		do	do	do	Sept. 18, 1940	do	5	do	Turning	do	2.1	46.1	21.4	24.7	54
327b		do	do	do	May 26, 1941	do	5	do	Green	do	1.4	49.0	20.5	28.5	58
327c		do	do	do	June 12, 1941	do	5	do	do	do	1.0	48.8	18.7	30.1	62
327d		do	do	do	July 1, 1941	do	5	do	do	do	1.7	46.9	20.2	26.7	57
327e		do	do	do	July 21, 1941	do	5	do	do	do	1.7	48.6	20.2	28.4	58
327f		do	do	do	Aug. 12, 1941	do	5	do	do	do	1.8	41.5	20.7	20.8	50
327g		do	do	do	Sept. 11, 1941	do	5	do	Turning	do	1.9	46.2	19.5	26.7	58
327h		do	do	do	June 17, 1943	do	5	do	Green	Fair	1.4	46.5	19.2	27.3	59
328a		do	do	do	Aug. 7, 1940	Restricted	6	Male	do	Good	1.6	46.1	21.2	24.9	54
328b		do	do	do	May 26, 1941	do	6	do	do	do	1.6	48.7	20.3	28.4	58
328c		do	do	do	June 12, 1941	do	6	do	do	do	1.2	49.0	19.8	29.2	60
328d		do	do	do	July 1, 1941	do	6	do	do	do	1.5	47.8	20.5	27.3	57
328e		do	do	do	July 21, 1941	do	6	do	do	do	1.5	47.2	19.8	27.4	58
328f		do	do	do	Aug. 12, 1941	do	6	do	do	do	1.3	45.5	20.3	25.2	55
328g		do	do	do	Sept. 11, 1941	do	6	do	do	do	1.8	46.1	19.5	26.6	58
329a		do	do	do	Aug. 2, 1939	Full	6	do	do	do	.7	50.0	18.4	31.6	63
329b		do	do	do	Sept. 8, 1939	do	6	do	Partly red	do	1.3	43.0	16.8	26.2	61
329c		do	do	do	June 27, 1940	do	10	do	Green	do	1.1	50.4	19.2	31.2	62
329d		do	do	do	July 26, 1940	do	10	do	do	do	1.3	48.4	18.3	30.1	62
329e		do	do	do	Sept. 14, 1940	do	10	do	Partly red	do	1.3	50.6	23.7	26.9	53
329f		do	do	do	Sept. 2, 1941	do	10	do	Green	do	1.4	49.4	20.0	29.4	60
329g		do	do	do	June 10, 1942	do	10	do	do	do	1.6	45.2	17.5	27.7	61
330a		do	do	do	July 31, 1939	Restricted	5	do	do	do	1.5	47.3	21.0	26.3	56
330b		do	do	do	June 28, 1940	do	5	do	do	do	1.5	44.6	20.1	24.5	55
330c		do	do	do	Aug. 7, 1940	do	5	do	do	do	1.5	44.3	21.0	23.3	53
330d		do	do	do	June 10, 1942	do	5	do	do	do	1.5	37.7	18.8	18.9	50
330e		do	do	do	July 3, 1943	do	5	do	do	do	1.4	44.4	21.1	23.3	52
330f		do	do	do	Aug. 2, 1943	do	5	do	do	do	1.7	43.7	19.7	24.0	55

See footnotes at end of table.

TABLE 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)—Continued

Species and sample No. [1]	Source				Date collected	Description					Analyses (moisture-free basis)				
	State	County	Locality [2]	Stand [3]		Exposure to sunlight	Height of plant	Sex [4]	Color of leaves when collected	Condition of cured sample	Insolubles in extractive	Soluble solids	Nontannin	Tannin	Purity of extractive [5]
							Feet				*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. glabra L.:															
331a	Iowa	Davis	Floris	Clone	Aug. 5, 1940	Full	3	Female	Green	Good	1.4	53.9	22.3	31.6	59
331b		do	do	do	Sept. 4, 1940	do	3	do	Partly red	do	1.3	50.6	20.2	30.4	60
331c		do	do	do	Sept. 18, 1940	do	3	do	do	do	2.2	47.2	19.8	27.4	58
331d		do	do	do	June 17, 1943	do	3	do	Green	do	1.2	55.2	21.6	33.6	61
332a		do	do	do	Aug. 7, 1940	do	8	do	do	do	1.6	46.6	21.8	24.8	53
332b		do	do	do	Aug. 21, 1940	do	8	do	Turning	do	1.3	44.1	20.3	23.8	54
332c		do	do	do	Sept. 17, 1941	do	8	do	do	do	1.5	44.6	19.7	24.9	56
333a		do	do	do	Aug. 2, 1939	do	4	do	Green	do	1.5	53.0	19.2	33.8	64
333b		do	do	do	Sept. 7, 1939	do	4	do	Red	do	1.7	45.8	17.8	28.0	61
333c		do	do	do	Sept. 11, 1940	do	5	do	Partly red	do	1.2	53.1	22.9	30.2	57
334a		do	do	do	Aug. 2, 1939	Restricted	4	do	Green	do	1.3	51.4	18.6	32.8	64
334b		do	do	do	Sept. 7, 1939	do	4	do	Partly red	do	1.9	48.2	20.2	28.0	58
334c		do	do	do	Sept. 11, 1940	Full	5	do	do	do	1.9	51.0	23.3	27.7	54
335a		do	do	do	Sept. 5, 1939	Restricted	6	Male	Green	do	2.0	46.3	22.2	24.1	52
335b		do	do	do	Aug. 21, 1940	do	7	do	do	do	1.2	45.8	22.3	23.5	51
336a		do	do	do	Sept. 7, 1939	do	6	Female	do	do	1.8	41.4	20.3	21.1	51
336b		do	do	do	Sept. 17, 1941	do	7	do	do	do	1.9	42.1	22.4	19.7	47
337a		do	do	do	Aug. 5, 1940	Full	3	Male	do	do	1.3	53.4	22.2	31.2	58
337b		do	do	do	June 17, 1943	do	3	do	do	do	1.3	50.6	21.0	29.6	58
338a		do	do	do	Aug. 7, 1940	do	6	do	do	do	1.2	44.8	20.2	24.6	55
338b		do	do	do	Aug. 21, 1940	do	6	do	Partly red	do	1.0	45.3	19.5	25.8	57
339a		do	do	do	Aug. 20, 1940	do	5	do	Green	do	1.1	42.8	21.7	21.1	49
339b		do	do	do	June 18, 1943	do	5	do	do	Fair	1.7	48.8	20.4	28.4	58
340		do	do	do	Sept. 5, 1939	Restricted	6	do	do	Good	1.7	43.5	22.6	20.9	48
341		do	do	do	Sept. 6, 1939	Full	4	do	do	do	1.6	45.6	20.3	25.3	56
342		do	do	do	do	do	4	do	Partly red	do	2.0	45.0	16.5	28.5	63
343		do	do	do	Aug. 21, 1940	do	5	do	Green	do	1.7	40.7	21.3	19.4	48
344		do	do	do	do	do	4	do	do	do	1.9	50.6	22.7	27.9	55
345		do	do	do	Sept. 11, 1940	do	9	do	Partly red	do	1.8	44.9	25.2	19.7	44
346		do	do	do	Sept. 5, 1939	Restricted	4	Female	Turning	do	1.6	46.9	19.6	27.3	58
347		do	do	do	Sept. 7, 1939	Full	4	do	Green	do	1.2	46.3	18.8	27.5	59
348		do	do	do	Sept. 8, 1939	Restricted	3	do	Partly red	do	2.4	46.0	20.7	25.3	55
349		do	do	do	Oct. 13, 1939	Full	4	do	Red	do	2.3	42.3	19.4	22.9	54
350		do	do	do	Aug. 21, 1940	do	5	do	Partly red	do	1.6	50.7	20.8	29.9	59
351		do	do	do	do	do	4	do	Turning	do	1.4	48.7	20.8	27.9	57
352		do	do	do	Sept. 4, 1940	do	5	do	Partly red	do	1.3	50.7	21.1	29.6	58
353		do	do	do	Sept. 11, 1940	do	5	do	Turning	do	2.1	51.1	25.8	25.3	50
354		do	do	do	do	do	4	do	Partly red	do	1.6	44.6	23.9	20.7	46
355		Pottawattamie.	Council Bluffs	Clump	Aug. 28, 1941	do			Green	do	1.2	40.1	21.1	19.0	47

R. lanceolata (A. Gray) Britton:															
356		Erath	Stephenville	do	July 10, 1940	do	18		do	do	3.4	32.2	19.1	13.1	41
357a		Hamilton	Hico	do	June 19, 1939	do			do	do	4.2	43.7	17.0	26.7	61
357b		do	do	do	July 10, 1940	do			do	do	2.7	40.7	18.6	22.1	54
358		Bosque	Iredell	do	do	do	15		do	do	3.1	40.5	18.3	22.2	55
359		McLennan	Waco	do	July 11, 1940	do			do	do	2.3	41.8	18.4	23.4	56
360		Coryell	McGregor	do	do	do			do	do	1.7	37.1	16.7	20.4	55
361		do	Gatesville	do	do	do	15		do	do	3.3	42.1	19.0	23.1	55
362		Mills	Goldthwaite	do	do	Restricted	17		do	do	3.4	37.3	19.4	17.9	48
363		do	Mullin	do	July 22, 1940	Full	3		Turning	do	4.4	35.2	20.1	15.1	43
364a		Brown	Brownwood	do	June 18, 1939	do	6		Green	do	3.3	35.5	17.7	17.8	50
364b		do	do	do	July 7, 1940	do	6		do	do	1.4	40.2	20.7	19.5	49
365		Lampasas	Lampasas	do	July 12, 1940	do	3		do	do	1.9	40.2	16.0	24.2	60
366		Travis	Austin	do	July 2, 1940	do			do	do	2.8	39.6	15.8	23.8	60
367a		Kendall	Comfort	do	June 14, 1939	Restricted	3		do	do	3.2	47.0	19.2	27.8	59
367b		do	do	do	July 3, 1940	do	3		do	do	2.0	40.6	17.5	23.1	57
368a		Kerr	Center Point	do	June 15, 1939	Full	2		do	do	2.0	42.9	20.0	22.9	53
368b		do	do	do	July 3, 1940	do	2		do	do	2.3	43.0	18.5	24.5	57
369a		do	Mountain Home.	do	June 15, 1939	do			do	do	1.4	45.0	17.8	27.2	60
369b		do	do	do	July 4, 1940	do			do	do	1.0	47.5	18.2	29.3	62
370		Coleman	Talpa	do	June 18, 1939	do	6		do	do	2.5	27.1	16.7	10.4	38
371a		Tom Green	Christoval	do	June 17, 1939	do			do	do	1.3	46.2	18.0	28.2	61
371b		do	do	do	July 5, 1940	do			do	do	1.5	48.6	18.4	30.2	62
372		Nolan	Blackwell	do	July 22, 1940	Restricted			do	do	3.2	34.2	20.9	13.3	39
R. microphylla Engelm.:															
373		Bexar	Elmendorf	do	Aug. 9, 1938	do	6			do	1.1	44.9	25.0	19.9	44
374		Tom Green	Christoval	do	June 17, 1939	do			Green	do	2.4	38.6	22.1	16.5	43
375		Edwards	Sonora	do	do	do			do	do	1.8	43.2	24.5	18.7	43
376		Crockett	Ozona	do	June 16, 1939	Full	3		do	do	2.3	45.8	24.8	21.0	46
377		Val Verde	Juno	do	do	do	3		do	do	4.1	46.6	26.1	20.5	44
R. trilobata Nutt.:															
378	Texas	Young	Loving	do	July 9, 1940	Restricted	4		do	do	.6	64.3	21.9	42.4	66
379		Jack	Jacksboro	do	do	do	4		do	do	.9	63.8	22.6	41.2	65
380		Palo Pinto	Mineral Wells	do	do	Full	2		do	do	1.6	61.1	22.8	38.3	63
381		Erath	Stephenville	do	July 10, 1940	Restricted	4		do	do	1.9	58.7	21.7	37.0	63
382		Hamilton	Hico	do	do	do	3		do	do	2.3	60.4	24.5	35.9	59
383		Bosque	Valley Mills	do	June 19, 1939	Full			do	do	1.2	58.8	20.6	38.2	65
384		do	do	do	July 10, 1940	Restricted	5		do	do	1.7	57.1	24.0	33.1	58
385		McLennan	Waco	do	July 11, 1940	Full	3		do	do	1.6	60.4	23.4	37.0	61
386		Coryell	McGregor	do	do	Restricted	3		do	do	1.0	59.2	21.0	38.2	65
387		do	Gatesville	do	do	do	4		do	do	1.4	59.6	21.0	38.6	65
388		Burnet	Lampasas	do	July 12, 1940	do			do	do	1.3	59.8	21.0	38.8	65
389		Travis	Austin	do	July 1, 1940	do	2		do	do	2.0	59.6	23.5	36.1	61
390		Baylor	Seymour	do	July 9, 1940	Full			do	do	1.3	61.8	24.0	37.8	61

See footnotes at end of table.

TABLE 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)—Continued

Species and sample No. [1]	Source: State	Source: County	Source: Locality [2]	Source: Stand [3]	Date collected	Description: Exposure to sunlight	Description: Height of plant	Description: Sex [4]	Description: Color of leaves when collected	Description: Condition of cured sample	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive [5]
R. trilobata Nutt.:							*Feet*				*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*
391		Throckmorton.	Throckmorton.	Clump	July 8, 1940	Restricted	3		Green	Good	1.6	62.0	23.9	38.1	61
392		Eastland	Cisco	do	do	Full	3		do	do	1.1	61.4	22.8	38.6	63
393		Brown	May	do	do	Restricted	2		do	do	1.1	64.6	23.5	41.1	64
394		Coleman	Coleman	do	June 18, 1939	do			do	do	1.5	62.3	19.9	42.4	68
395		do	do	do	July 6, 1940	do	1		do	do	2.5	63.1	22.5	40.6	64
396		do	do	do	do	do	1		do	do	2.4	64.6	23.2	41.4	64
397		do	do	do	do	do	1		do	do	2.0	64.8	22.9	41.9	65
398		do	do	do	do	do	1		do	do	1.7	64.8	22.6	42.2	65
399		do	do	do	do	Full	1		do	do	2.3	65.1	22.4	42.7	66
400		do	do	do	do	do	1		do	do	1.7	62.5	21.4	41.1	66
401		Brown	Brownwood	do	July 7, 1940	Restricted	2		do	do	1.5	62.3	23.1	39.2	63
402		Bexar	Helotes	do	Aug. 9, 1938	do	3		do	do	1.4	62.2	23.6	38.6	62
403a		do	San Antonio	do	June 14, 1939	do			do	do	1.6	61.0	23.5	37.5	61
403b		do	do	do	July 2, 1940	do	1		do	do	1.3	58.5	21.1	37.4	64
404		Kendall	Comfort	do	July 3, 1940	do			do	do	1.4	58.0	20.5	37.5	65
405a		Kerr	Kerrville	do	June 15, 1939	Full	2		do	do	1.3	61.3	22.7	38.6	63
405b		do	do	do	July 3, 1940	Restricted			do	do	1.0	64.5	20.9	43.6	68
406		Kimble	Junction	do	July 4, 1940	do			do	do	1.2	64.0	21.4	42.6	67
407		Coke	Bronte	do	July 22, 1940	do	4		do	do	2.4	62.6	25.4	37.2	59
408a		Edwards	Rocksprings	do	June 17, 1939	do			do	do	1.5	62.9	23.5	39.4	63
408b		do	do	do	July 5, 1940	do	3		do	do	1.8	59.2	22.9	36.3	61
R. typhina Torn.:															
409	New York	Onondaga	Syracuse	District	Oct. 22, 1943				Red	Good	2.4	44.3	18.5	25.8	58
410a	New York	Ontario	Geneva	Clump	June 26, 1939	Full			Green	do	1.6	39.3	20.1	19.2	49
410b	New York	do	do	do	Aug. 9, 1939	do				do	1.8	40.1	19.3	20.8	52
410c	New York	do	do	do	Sept. 11, 1940	do			Red	do	2.4	42.0	19.6	22.4	53
411	New York	Seneca	Interlaken	do	do	do			Green	Fair	2.2	45.2	18.5	26.7	59
412	New York	Yates	Rock Stream	do	Sept. 10, 1940	do			do	Good	2.1	42.5	19.2	23.3	55
413	New York	Tioga	Owego	do	Sept. 12, 1940	do			Turning	Fair	1.3	37.0	19.4	17.6	48
414	New York	Steuben	Lindley	do	Sept. 10, 1940	do			do	Good	1.7	45.0	18.3	26.7	59

415	Pennsylvania.	Susquehanna.	New Milford	District	Oct. 22, 1943				Red	do	2.1	47.6	20.6	27.0	57
416		Northampton.	Easton	do	do				do	do	2.4	44.0	15.7	28.3	64
417		Bradford	Wyalusing	Clump	Sept. 12, 1940	Full			Green	do	1.7	44.3	19.3	25.0	56
418		Wyoming	Osterhout	do	do	Restricted			Turning	do	1.8	42.3	20.4	21.9	52
419		Tioga	Blossburg	do	Sept. 10, 1940	do			do	Bad	1.7	37.4	19.3	18.1	48
420		Lycoming	Williamsport	do	do	Full			do	Good	2.2	43.2	20.2	23.0	53
421		Montour	Danville	do	Sept. 12, 1940	do			Green	Fair	2.1	45.8	21.7	24.1	53
422		Union	Winfield	do	Sept. 10, 1940	Restricted			do	do	1.4	36.2	19.1	17.1	47
423		Perry	Amity Hall	do	do	Full			do	Good	1.7	38.2	17.4	20.8	54
424a [7]		Montgomery.	Wyndmoor	do	July 6, 1943	do	9		do	do	1.0	40.5	21.1	19.4	48
424b [7]		do	do	do	Oct. 22, 1943	do	9		Red	do	2.9	42.0	17.2	24.8	59
425 [7]		do	do	do	July 6, 1943	Restricted	8		Green	do	1.5	42.9	22.3	20.6	48
426a [7]		do	do	Field	do	Full	12	Female	do	do	1.2	43.2	22.0	21.2	49
424b [7]		do	do	do	Aug. 16, 1943	do	12	do	do	do	1.9	42.0	21.0	21.0	50
427		Fulton	Hustontown	do	July 6, 1943	do	5		do	do	1.8	48.1	18.1	30.0	62
428		do	Wells Tannery	Clump	July 13, 1943	Restricted	15		do	do	1.8	39.6	19.5	20.1	51
429		Bedford	Breezewood	Field	July 15, 1943	Full	9		do	do	1.4	47.5	22.0	25.5	54
430		do	Everett	Clump	do	do	7		do	do	1.5	43.4	21.1	22.3	51
431	New Jersey.	Salem	Deepwater	do	Aug. 2, 1943	do	8		do	do	1.4	39.7	20.2	19.5	49
432	Maryland.	Cecil	Elk Neck	Single plant	Aug. 21, 1941		11		do	do	1.3	42.1	19.9	22.2	53
433		do	do	Clump	do				do	Fair	1.6	40.4	21.6	18.8	47
434		do	do	do	do				do	Good	2.0	49.9	23.6	26.3	53
435		Harford	Havre de Grace.	do	do				do	Poor	1.2	44.6	21.1	23.5	53
436		Baltimore	Kingsville	do	do				do	Fair	1.7	42.1	20.6	21.5	51
437		Frederick	Thurmont	do	Sept. 10, 1940	Restricted			Turning	Bad	1.2	37.9	18.1	19.8	52
438a		do	Brunswick	do	June 29, 1939	do	15		Green	Good	2.3	50.0	21.9	28.1	56
438b		do	do	do	Aug. 18, 1939	do	15		do	do	2.0	46.1	19.4	26.7	58
438c		do	do	do	June 26, 1940	do	15		do	do	2.5	57.1	20.1	37.0	65
438d		do	do	do	Sept. 5, 1940	do	15			Poor	2.1	40.9	18.3	22.6	55
439a		do	Point of Rocks	do	June 29, 1939	Full	7		Green	Good	1.6	50.3	16.4	33.9	67
439b		do	do	do	Aug. 18, 1939	do	7		do	do	2.1	49.6	18.8	30.8	62
439c		do	do	do	June 26, 1940	do	7		do	do	2.1	49.4	19.4	30.0	61
439d		do	do	do	Sept. 5, 1940	do	7			do	2.6	51.2	20.7	30.5	60
440		Washington.	Keedysville	Field	June 22, 1943	do	7		Green	do	1.5	50.9	18.8	32.1	63
441		Montgomery.	Potomac	do	July 11, 1938	Restricted			do	do	2.3	51.1	18.2	32.9	64
442a	West Virginia.	Jefferson	Bolivar	Clump	June 20, 1939	do	7		do	do	1.9	46.3	21.2	25.1	54
442b		do	do	do	Aug. 18, 1939	do	7		do	do	2.8	45.2	20.0	25.2	56
442c		do	do	do	June 26, 1940	do	7		do	do	1.4	48.3	19.6	28.7	59
442d		do	do	do	Sept. 5, 1940	do	7			Fair	2.4	40.2	20.0	20.2	50

See footnotes at end of table.

TABLE 13.—*Source, description, and tannin analyses of leaves of 8 species of sumac* (Rhus)—Continued

Species and sample No.[1]	Source: State	Source: County	Source: Locality[2]	Source: Stand[3]	Date collected	Description: Exposure to sunlight	Description: Height of plant	Description: Sex[4]	Description: Color of leaves when collected	Description: Condition of cured sample	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive
							Feet				*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. typhina Torn.:															
443	Virginia	Fairfax	Great Falls	Clump	July 18, 1938	Full	5		Green	Good	1.5	42.8	19.2	23.6	55
444a	Virginia	do	do	do	June 29, 1939	Restricted	12		do	do	1.9	47.0	19.3	27.7	59
444b	Virginia	do	do	do	Aug. 18, 1939	do	12		Turning	do	1.8	47.4	19.3	28.1	59
444c	Virginia	do	do	do	June 26, 1940	do	12		Green	do	2.3	54.1	20.4	33.7	62
444d	Virginia	do	do	do	Sept. 5, 1940	do	12			Fair	2.0	46.9	16.4	30.5	65
445a	Virginia	Fauquier	New Baltimore.	do	June 26, 1939	Full	6		Green	Good	2.1	49.6	20.2	29.4	59
445b	Virginia	do	do	do	Aug. 18, 1939	do	6		do	do	2.9	49.8	21.5	28.3	57
445c	Virginia	do	do	do	June 26, 1940	do	6		do	do	1.8	51.7	20.7	31.0	60
445d	Virginia	do	do	do	Sept. 5, 1940	do	6			Fair	1.7	47.5	18.6	28.9	61
446a	Virginia	Prince Edward.	Farmville	do	June 27, 1939	Restricted	2		Green	Good	1.6	38.0	19.3	18.7	49
446b	Virginia	do	do	do	Aug. 16, 1939	do	2		do	do	2.1	37.0	19.5	17.5	47
446c	Virginia	do	do	do	June 26, 1940	do	2		do	do	2.0	47.4	21.1	26.3	55
446d	Virginia	do	do	do	Sept. 5, 1940	do	2			do	1.8	38.8	20.2	18.6	48
447	Virginia	Pulaski	Pulaski	do	Aug. 28, 1940	do			Green	Fair	1.2	32.1	19.4	12.7	40
448	Virginia	Bland	Rocky Gap	do	do	Full			do	do	1.6	42.8	15.7	27.1	63
449	North Carolina.	Madison	Marshall	do	Aug. 20, 1940	Restricted			Turning	Bad	1.8	39.5	19.6	19.9	50
450	Tennessee	Cannon	Woodbury	do	Aug. 26, 1940	Full			Green	Poor	1.6	42.9	18.1	24.8	58
451	Iowa	Clayton	McGregor	do	Sept. 23, 1939	do	8		Red	Good	3.0	52.0	20.1	31.9	61
452	Iowa	do	Guttenberg	do	do	do	10		Green	do	1.8	46.0	21.8	24.2	53
453	Iowa	do	do	do	do	do	10		do	do	1.7	37.4	22.6	14.8	40
454	Iowa	do	do	do	do	do	10		do	do	1.8	43.8	22.4	21.4	49
455	Iowa	Dubuque	Dubuque	do	Sept. 1, 1940	do	6		do	do	1.6	44.9	22.5	22.4	50

R. virens Lindh.:															
456	Texas	Bexar	Helotes	do	Aug. 9, 1938	do	6			do	3.8	46.7	21.6	25.1	54
457		Edwards	Sonora	do	June 17, 1939	Restricted	4		Green	do	3.5	40.9	22.5	18.4	45
458		Crockett	Ozona	do	June 16, 1939	Full	3		do	do	3.3	39.7	22.1	17.6	44

[1] Species are listed alphabetically. Under each species, samples are listed approximately in the order of their geographic source, those from the most northern and eastern locations being given first. This order was chosen only for convenience. When 2 or more samples were collected from the same plant, clump, or field on different dates, they were given the same number, and letters were added to distinguish between the different collections. For example, samples 3a, 3b, 3c, 3d, and 3e were collected from the same clump on 5 dates.

[2] The town, village, or hamlet nearest to the point of collection, as determined from a State map. Usually the place mentioned was in the county in which the sample was taken, but in a few cases, it was in an adjoining county.

[3] "Single plant" indicates that leaves were taken from 1 or more stalks from a single crown. "Clump" indicates that leaves were taken from a group of plants in a restricted location in a field; in many instances, they were taken from a single clone; in others, from 2 or more clones growing close together. "Field" indicates that the sample was taken from a number of clumps growing in different locations in a field. "District" indicates that the sample was collected from several fields to obtain a sample representative of the district.

[4] Sex was not determined accurately in all instances. Some plants marked female may have borne male flowers in addition to female flowers or seed clusters.

[5] The value for purity of extractive was calculated by dividing the percentage of tannin by the percentage of soluble solids and multiplying by 100.

[6] *Rhus copallina* L. var. *leucantha* (Jacq.) D. C.

[7] The analyses were calculated from separate analyses of leaflets and petioles.

TABLE 14.—*Source, description, and tannin analyses of leaflets and petiole-rachises of 3 species of sumac* (Rhus)

Species and sample No.[1]	Sample No. of corresponding leaf	Source: State	Source: County	Source: Locality	Source: Stand	Date collected	Description: Color of leaves when collected	Description: Condition of cured sample	Leaflets: Proportion of leaf	Leaflets: Insolubles in extractive	Leaflets: Soluble solids	Leaflets: Nontannin	Leaflets: Tannin	Leaflets: Purity of extractive	Petiole-rachises: Insolubles in extractive	Petiole-rachises: Soluble solids	Petiole-rachises: Nontannin	Petiole-rachises: Tannin	Petiole-rachises: Purity of extractive
									Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina:																			
501	24b	New Jersey	Ocean	Whiting	Clump	Aug. 2, 1943	Green	Good	83.4	1.5	53.7	19.3	34.4	64	0.7	29.4	18.8	10.6	36
502	25	do	Atlantic	Absecon	District	do	do	do	80.8	1.8	46.2	19.3	26.9	58	.8	27.9	18.4	9.5	34
503	26	do	Cape May	Seaville	do	do	do	do	80.6	2.1	45.5	19.1	26.4	58	1.1	29.5	18.8	10.7	36
504	29	do	Salem	Deepwater	Clump	do	do	do	82.9	1.6	51.7	17.9	33.8	65	1.0	29.7	18.9	10.8	36
505	30b	do	do	do	do	do	do	do	80.0	1.9	48.1	20.5	27.6	57	.9	28.4	19.3	9.1	32
506	32b	do	do	Salem	do	do	do	do	79.6	2.3	45.4	19.5	25.9	57	1.2	30.5	20.3	10.2	33
507	35b	do	do	Cohansey	do	do	do	do	79.7	1.4	54.6	21.1	33.5	61	1.4	33.6	22.2	11.4	34
508	----	Maryland	Charles	Wicomico	do	Sept. 12, 1936	do	do	----	2.4	51.1	25.5	25.6	50	----	----	----	----	----
509	----	do	do	do	do	Aug. 1, 1937	do	do	----	1.4	52.7	20.7	32.0	61	----	----	----	----	----
510	----	Iowa	Van Buren	Keosauqua	do	Sept. 5, 1938	do	Fair	85.1	2.5	56.2	18.4	37.8	67	1.2	30.0	15.1	14.9	50
R. glabra:																			
511	----	New York	Steuben	Corning	----	July 31, 1943	do	Good	----	1.5	46.9	24.2	22.7	48	----	----	----	----	----
512a	206a	Pennsylvania	Montgomery	Wyndmoor	Field	July 6, 1943	do	do	79.9	1.0	54.1	20.7	33.4	62	.6	20.1	16.5	3.6	18
512b	206b	do	do	do	do	Oct. 22, 1943	Red	do	78.8	2.7	60.4	19.8	40.6	67	.8	22.2	16.8	5.4	24
513a	----	do	do	do	Clump	Oct. 31, 1941	do	do	----	2.7	58.9	21.4	37.5	64	----	----	----	----	----
513b	205b	do	do	do	do	July 6, 1943	Green	do	76.0	1.1	56.3	21.0	35.3	63	.5	24.6	19.0	5.6	23
513c	205c	do	do	do	do	Oct. 22, 1943	Red	do	75.2	3.3	55.0	20.3	34.7	63	.8	23.5	16.7	6.8	20
514a	208a	do	do	do	Field	July 6, 1943	Green	do	78.7	1.8	53.2	24.1	29.1	55	.7	20.2	16.1	4.1	20
514b	208b	do	do	do	do	Aug. 16, 1943	do	do	77.0	1.3	51.6	23.2	28.4	55	.8	21.9	17.6	4.3	20
515a	209a	do	do	do	Clump	July 13, 1943	do	do	79.2	1.8	50.2	21.5	28.7	57	.6	20.6	16.9	3.7	18
515b	209b	do	do	do	do	Aug. 16, 1943	do	do	79.1	1.7	49.9	23.6	26.3	53	.7	23.3	19.1	4.2	18
516a	207a	do	do	do	do	July 16, 1943	do	do	80.9	1.4	47.8	25.2	22.6	47	.9	24.3	20.1	4.2	17
516b	207b	do	do	do	do	Oct. 22, 1943	Red	do	78.0	3.2	50.0	20.1	29.9	60	.9	22.8	17.7	5.1	22
517	219	New Jersey	Salem	Deepwater	do	Aug. 2, 1943	Green	do	78.4	1.5	55.9	22.1	33.8	60	.7	25.4	19.0	6.4	25
518	220	do	do	Quinton	do	do	do	do	77.6	1.6	52.1	23.4	28.7	55	.6	27.4	21.3	6.1	22
519	229	Maryland	Washington	Sharpsburg	do	June 19, 1942	do	do	[2]80.2	1.6	46.8	18.3	28.5	61	.6	18.3	15.4	2.9	16
520	243	do	Allegany	Flint Stone	do	do	do	do	[2]83.9	1.6	55.3	18.3	37.0	67	.8	22.9	18.3	4.6	20
521	244	do	do	do	do	do	do	do	[2]84.5	1.9	54.1	19.7	34.4	64	.7	23.3	18.7	4.6	20
522	245	do	do	do	do	do	do	do	[2]81.9	2.1	48.2	19.5	28.7	60	.8	22.6	19.1	3.5	15
523	----	do	Montgomery	Bethesda	do	Oct. 23, 1937	Red	do	[2]72.1	2.3	57.0	23.9	33.1	58	.7	26.2	21.1	5.1	19
524	----	do	Charles	Wicomico	do	Aug. 1, 1937	Green	do	79.1	1.4	55.8	24.0	31.8	57	1.7	31.6	23.2	8.4	27
525	263	do	St. Marys	Budds Creek	do	July 15, 1938	do	do	79.8	1.8	49.2	19.3	29.9	61	.7	21.5	15.9	5.6	27

526	265	West Virginia	Berkeley	Martinsburg	do	June 19, 1942	do	do	[2]80.3	2.2	50.4	18.5	31.9	63	.6	19.5	15.4	4.1	21
527	266	Virginia	Fairfax	McLean	do	July 18, 1938	do	do	[2]73.2	1.5	49.9	20.8	29.1	58	-----	-----	-----	-----	-----
528	-----		Davis	Floris	do	Sept. 2, 1938	do	Fair	[2]86.1	1.6	49.7	18.2	31.5	63	.6	24.6	15.6	9.0	37
529	-----		do	do	do	Sept. 10, 1938	do	Bad	[2]75.6	2.3	44.6	21.1	23.5	53	1.0	22.5	16.0	6.5	29
530	-----		do	do	do	do	do	do	[2]75.4	2.1	47.3	20.5	26.8	57	.7	22.9	17.3	5.6	24
531	-----	Iowa	do	do	do	Sept. 15, 1938	do	Good	[2]81.5	2.2	50.5	20.2	30.3	60	.6	25.4	18.5	6.9	27
532	-----		do	do	do	do	do	do	[2]80.1	1.9	52.7	20.5	32.2	61	1.0	23.4	16.4	7.0	30
533	-----		do	do	do	Sept. 16, 1938	Turning	do	[2]78.7	2.2	47.6	18.5	29.1	61	.8	24.1	15.5	8.6	36
534	-----		do	do	do	do	do	do	[2]79.8	1.8	50.1	19.5	30.6	61	.7	26.4	17.4	9.0	34
535	-----		do	do	do	Sept. 19, 1938	do	do	[2]80.8	2.2	49.8	22.6	27.2	55	.8	26.3	19.7	6.6	25
R. typhina:																			
536	-----	New York	Steuben	Corning	-----	July 31, 1943	do	do	-----	1.7	52.2	24.8	27.4	52	-----	-----	-----	-----	-----
537a	-----		Montgomery	Wyndmoor	Clump	Sept. 21, 1942	Green	do	-----	1.5	50.7	27.3	23.4	46	.8	24.1	19.2	4.9	20
537b	424a		do	do	do	July 6, 1943	do	do	76.6	1.2	46.4	22.1	24.3	52	.6	21.0	17.7	3.3	16
537c	424b		do	do	do	Oct. 22, 1943	Red	do	74.6	3.5	50.4	18.5	31.9	63	1.1	17.2	13.2	4.0	23
538a	-----	Pennsylvania	do	do	do	Sept. 21, 1942	Green	do	-----	2.0	47.7	26.9	20.8	44	.7	19.7	16.5	3.2	16
538b	425		do	do	do	July 6, 1943	do	do	80.9	1.7	48.1	23.0	25.1	52	.5	21.1	19.5	1.6	8
539a	426a		do	do	Field	do	do	do	79.1	1.4	48.7	22.8	25.9	53	.6	22.2	18.9	3.3	15
539b	426b		do	do	do	Aug. 16, 1943	do	do	79.1	2.1	47.1	21.8	25.3	54	1.0	22.7	18.2	4.5	20
540	431	New Jersey	Salem	Deepwater	Clump	Aug. 2, 1943	do	do	77.6	2.2	45.5	21.3	24.2	53	1.0	22.9	18.7	4.2	18
541	-----	Maryland	Montgomery	Potomac	Single plant	July 11, 1938	do	do	-----	1.4	63.4	18.2	45.2	71	-----	-----	-----	-----	-----
542	443	Virginia	Fairfax	Great Falls	Clump	July 18, 1938	do	do	[2]72.8	1.9	54.9	20.1	34.8	63	.8	17.1	13.1	4.0	23
543	-----		Clayton	McGregor	do	Sept. 24, 1938	do	do	[2]73.1	2.3	45.3	21.5	23.8	53	.9	22.8	18.6	4.2	18
544	-----		do	do	do	do	do	do	[2]60.4	1.7	42.5	21.1	21.4	50	.8	25.7	20.1	5.6	22
545	-----	Iowa	do	do	do	do	Partly red	Fair	-----	2.1	43.0	22.0	21.0	49	.9	23.2	18.7	4.5	19
546	-----		do	do	do	do	Green	do	[2]78.8	1.9	48.0	23.5	24.5	51	.9	28.2	22.5	5.7	20
547	-----		do	do	do	do	Turning	Good	[2]70.7	2.3	46.6	23.5	23.1	50	1.0	23.4	19.8	3.6	15
548	-----		do	do	do	do	Partly red	do	[2]71.2	2.7	48.4	20.3	28.1	58	1.1	23.5	17.9	5.6	24

[1] One number only has been assigned to each pair of leaflet and petiole-rachis samples.
[2] Calculated on the air-dry basis. The difference between results calculated on the air-dry basis and those on the moisture-free basis is usually small.

TABLE 15.—*Source, description, and tannin analyses of stems of 6 species of sumac* (Rhus)

Species and sample No.	Sample No. of corresponding leaf or leaflet	Source: State	Source: County	Source: Locality	Source: Stand	Date collected	Description: Height of plant	Description: Age [1]	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive
							Feet	*Years*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. aromatica:													
549	8	Iowa	Davis	Floris	Clump	Sept. 1, 1938	2	----	2.0	22.0	16.9	5.1	23
550	9	Iowa	do	do	do	Sept. 15, 1938	3	----	4.0	28.0	21.0	7.0	25
551	2	Iowa	Van Buren	Keosauqua	do	Sept. 5, 1938	2	----	2.2	20.7	15.3	5.4	26
R. copallina:													
552	24a	New Jersey	Ocean	Whiting	do	Oct. 17, 1941	4	1	2.5	18.2	15.1	3.1	17
553	24b	New Jersey	do	do	do	Aug. 2, 1943	4	1	2.7	18.6	16.5	2.1	11
554 [2]	24b	New Jersey	do	do	do	do	4	3	1.2	12.3	9.8	2.5	20
555 [2]	----	New Jersey	Atlantic	Smithville	do	do	6	6 and 8	1.2	11.8	8.6	3.2	27
556	27	New Jersey	Gloucester	Gibbstown	do	Oct. 15, 1941	7	1 and 2	2.3	15.5	11.8	3.7	24
557	28	New Jersey	Salem	Deepwater	do	Oct. 14, 1941	4	1	2.7	20.4	15.4	5.0	25
558	29	New Jersey	do	do	do	Aug. 2, 1943	3	1	2.2	20.9	16.6	4.3	21
559	30a	New Jersey	do	do	do	Oct. 14, 1941	6	1 and 2	2.4	18.1	14.5	3.6	20
560	30b	New Jersey	do	do	do	Aug. 2, 1943	6	1	2.3	16.0	13.1	2.9	18
561 [2]	30b	New Jersey	do	do	do	do	6	2	1.3	12.4	9.5	2.9	23
562 [2]	31b	New Jersey	do	do	do	do	6	2	1.1	9.8	7.1	2.7	28
563	32a	New Jersey	do	Salem	do	Oct. 14, 1941	4	1	2.3	19.7	14.7	5.0	25
564	33	New Jersey	do	Alloway	do	Oct. 15, 1941	5	----	2.1	19.7	14.7	5.0	25
565	35a	New Jersey	do	Cohansey	do	Oct. 16, 1941	3	1	1.5	19.4	15.9	3.5	18
566	35b	New Jersey	do	do	do	Aug. 2, 1943	3	1	1.9	15.4	12.7	2.7	18
567 [2]	35b	New Jersey	do	do	do	do	3	2	1.0	11.5	9.0	2.5	22
568	36	New Jersey	do	Canton	do	Oct. 16, 1941	5	1	2.7	21.8	17.0	4.8	22
569	37	New Jersey	Cumberland	Roadstown	do	do	5	1	2.5	17.7	14.1	3.6	20
570 [2]	38	New Jersey	do	Mauricetown	do	Aug. 2, 1943	20	20 and 22	1.5	10.5	7.5	3.0	29
571	40	Pennsylvania	Fulton	Waterfall	do	July 13, 1943	4	1	2.2	25.3	20.5	4.8	19
572	41	Pennsylvania	Bedford	Everett	do	July 15, 1943	4	1	2.7	27.9	22.6	5.3	19
573	42	Maryland	Cecil	Elk Neck	do	Aug. 21, 1941	----	1	2.2	21.4	17.0	4.4	21
574	----	Maryland	Prince Georges	Beltsville	do	Oct. 13, 1941	4	1	2.3	22.9	18.3	4.6	20
575	----	Maryland	do	do	do	do	4	1	1.9	20.4	17.3	3.1	15
576	----	Maryland	do	do	do	Oct. 21, 1941	1	1	2.9	24.7	19.4	5.3	21
577	----	Maryland	do	do	do	do	1	1	2.3	22.0	17.7	4.3	20
578	63c	Maryland	Charles	Wicomico	do	June 30, 1937	4	1	.8	20.0	14.7	5.3	27
579	----	Maryland	do	do	Single plant	July 28, 1937	9	1	1.5	15.1	11.1	4.0	26
580 [2]	----	Maryland	do	do	do	do	9	Old	1.2	11.3	6.6	4.7	42
581	70	Maryland	do	do	Field	do	----	1	.9	19.1	13.6	5.5	29
582	70	Maryland	do	do	do	do	----	Old	1.0	11.9	7.8	4.1	34
583	----	Maryland	do	do	Clump	Aug. 22, 1937	6	1	2.1	24.8	17.9	6.9	28
584 [2]	----	Maryland	do	do	Single plant	do	6	Old	1.5	16.4	12.4	4.0	24

585		District of Columbia.		Washington	Clump	Oct. 13, 1941	4	1	2.3	23.7	19.5	4.2	18
586	103	Virginia	Norfolk	Wallaceton	District	June 27, 1942	3		1.8	19.5	14.7	4.8	25
587	104	Virginia	Isle of Wight	Windsor	do	do	2		2.8	28.7	21.5	7.2	25
588	93	Virginia	Cumberland	Cumberland	do	Aug. 12, 1941			2.6	18.8	15.1	3.7	20
589	116	North Carolina	Beaufort	Washington	Clump	June 27, 1942	3		1.6	22.3	16.9	5.4	25
590	510	Iowa	Van Buren	Keosauqua	do	Sept. 5, 1938			1.5	18.6	13.6	5.0	27
R. glabra:													
591		Pennsylvania	Montgomery	Wyndmoor	do	May 3, 1943	3	Old	1.3	16.1	12.1	4.0	25
592 [2]	207a	Pennsylvania	do	do	do	July 16, 1943	6	1	2.0	26.7	22.6	4.1	15
593	213	Pennsylvania	Huntingdon	Burnt Cabins	Field	July 6, 1943	4	1	2.0	24.1	18.2	5.9	24
594	214	Pennsylvania	Fulton	Waterfall	do	July 13, 1943	4	1	2.1	26.0	19.6	6.4	25
595	215	Pennsylvania	do	Hustontown	Clump	July 6, 1943	6	1	1.4	19.9	15.4	4.5	23
596	216	Pennsylvania	do	Wells Tannery	do	July 13, 1943	10	1	1.8	24.3	19.7	4.6	19
597	217	Pennsylvania	Bedford	Breezewood	do	July 15, 1943	6	1	1.4	23.3	19.9	3.4	15
598	218	Pennsylvania	do	Everett	do	do	6	1	1.8	24.8	19.7	5.1	21
599	221	Maryland	Baltimore	Kingsville	do	Aug. 21, 1941		1	1.9	21.7	18.4	3.3	15
600	227	Maryland	Washington	Williamsport	Field	July 28, 1943		1 and 2	1.1	12.7	10.0	2.7	21
601	232	Maryland	do	Indian Springs	do	do		1 and 3	1.3	18.0	11.9	6.1	34
602	235a	Maryland	do	Hancock	Clump	do	6	1	2.4	26.1	19.5	6.6	25
603	235a	Maryland	do	do	do	do	6	2 and 4	1.4	18.7	11.9	6.8	36
604	236a	Maryland	do	do	do	do	6	1 and 4	1.5	18.0	12.0	6.0	33
605	237a	Maryland	do	do	do	do	5	1	1.5	26.0	18.1	7.9	30
606	237a	Maryland	do	do	do	do	5	2 and 5	1.5	18.0	10.6	7.4	41
607	238a	Maryland	do	do	do	do	8	1	2.2	22.4	17.6	4.8	21
608	238a	Maryland	do	do	do	do	8	Old	1.7	14.7	9.2	5.5	37
609		Maryland	Prince Georges	Beltsville		Aug. 3, 1943		1	1.9	25.0	19.9	5.1	20
610		Maryland	do	do		do		Old	1.0	12.7	9.3	3.4	27
611		Virginia	Arlington	Arlington	Clump	July 31, 1943	5	1	1.1	19.2	14.2	5.0	26
612		Virginia	do	do	do	do	5	Old	1.2	14.0	9.4	4.6	33
613	532	Iowa	Davis	Floris	do	Sept. 15, 1938			2.1	20.9	15.8	5.1	24
614	531	Iowa	do	do	do	do			2.9	21.3	16.5	4.8	23
615	535	Iowa	do	do	do	Sept. 19, 1938			2.9	22.8	17.6	5.2	23
R. lanceolata:													
616	357b	Texas	Hamilton	Hico	do	July 10, 1940			2.3	16.9	13.1	3.8	22
617	364b	Texas	Brown	Brownwood	do	July 7, 1940	6		1.9	14.8	12.3	2.5	17
618	367b	Texas	Kendall	Comfort	do	July 3, 1940	3		1.5	12.9	10.4	2.5	19
619	368b	Texas	Kerr	Center Point	do	do	2		1.8	15.9	13.1	2.8	18
620	369b	Texas	do	Mountain Home	do	July 4, 1940	13		1.8	15.8	12.2	3.6	23
621	371b	Texas	Tom Green	Christoval	do	July 5, 1940	10		1.4	16.1	11.9	4.2	26
R. trilobata:													
622	384	Texas	Bosque	Valley Mills	do	July 10, 1940	5		2.2	15.3	10.6	4.7	31
623	389	Texas	Travis	Austin	do	July 1, 1940	2		2.1	16.0	10.6	5.4	34
624		Texas	Coleman	Coleman	do	July 6, 1940	2		2.3	18.4	12.8	5.6	30
625	403b	Texas	Bexar	San Antonio	do	July 2, 1940	2		2.3	17.3	11.0	6.3	36
626	405b	Texas	Kerr	Kerrville	do	July 3, 1940			1.0	19.7	14.0	5.7	29
627	408b	Texas	Edwards	Rocksprings	do	July 5, 1940	3		2.0	16.2	11.7	4.5	28

See footnotes at end of table.

TABLE 15.—*Source, description, and tannin analyses of stems of 6 species of sumac* (Rhus)—Continued

Species and sample No.	Sample No. of corresponding leaf or leaflet	Source: State	Source: County	Source: Locality	Source: Stand	Date collected	Description: Height of plant	Description: Age [1]	Analyses (moisture-free basis): Insolubles in extractive	Analyses (moisture-free basis): Soluble solids	Analyses (moisture-free basis): Nontannin	Analyses (moisture-free basis): Tannin	Analyses (moisture-free basis): Purity of extractive
							Feet	*Years*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. typhina:													
628 [2]	431	New Jersey	Salem	Deepwater	Clump	Aug. 2, 1943	8	1	1.2	19.5	17.0	2.5	13
629	424a	Pennsylvania	Montgomery	Wyndmoor	do	July 6, 1943	9	1	1.3	17.7	15.1	2.6	15
630 [2]	424a	Pennsylvania	do	do	do	do	9	2	1.2	10.4	7.9	2.5	24
631 [2]	424a	Pennsylvania	do	do	do	do	9	3	1.1	8.7	6.5	2.2	25
632 [2]	425	Pennsylvania	do	do	do	do	8	1	1.3	20.4	17.3	3.1	15
633 [2]	425	Pennsylvania	do	do	do	do	8	2	1.1	10.6	8.2	2.4	23
634 [2]	425	Pennsylvania	do	do	do	do	8	3	1.2	8.5	6.4	2.1	25
635	427	Pennsylvania	Fulton	Hustontown	Field	do	5	1	1.6	24.1	18.6	5.5	23
636	428	Pennsylvania	do	Wells Tannery	Clump	July 13, 1943	15	1	1.4	19.0	15.8	3.2	17
637	429	Pennsylvania	Bedford	Breezewood	Field	July 15, 1943	9		2.2	24.7	21.1	3.6	15
638	430	Pennsylvania	do	Everett	Clump	do	7		1.6	23.4	19.9	3.5	15
639	432	Maryland	Cecil	Elk Neck	Single plant	Aug. 21, 1941	11	1	1.7	18.8	15.9	2.9	15
640	433	Maryland	do	do	Clump	do		1	2.1	21.6	17.8	3.8	18
641	434	Maryland	do	do	do	do		1	2.2	22.0	17.3	4.7	21
642	435	Maryland	Harford	Havre de Grace	do	do		1	1.6	15.4	13.4	2.0	13
643	436	Maryland	Baltimore	Kingsville	do	do		1	1.7	17.5	15.5	2.0	11
644 [2]		Maryland	Montgomery	Potomac	Single plant	July 11, 1938	11	1	1.3	17.6	14.5	3.1	18
645 [2]		Maryland	do	do	do	do	11	Old	1.3	10.7	7.8	2.9	27
646	545	Iowa	Clayton	McGregor	Clump	Sept. 24, 1938			1.7	19.3	15.2	4.1	21
647	546	Iowa	do	do	do	do			2.3	21.4	17.3	4.1	19
648	544	Iowa	do	do	do	do			1.5	15.2	12.2	3.0	20

[1] Age was determined by ring count. "1" indicates current year's growth. "Old" indicates that the sample was more than 1 year old but the exact age was not determined. Some samples consisted of stems of different ages.

[2] The analyses were calculated from separate analyses of bark and wood.

TABLE 16.—*Source, description, and tannin analyses of bark and wood of 3 species of sumac* (Rhus)

Species and sample No.	Sample No. of corresponding stem	Source: State	Source: County	Source: Locality	Source: Stand	Date collected	Description: Height of plant	Description: Age	Bark: Proportion of stem	Bark: Insolubles in extractive	Bark: Soluble solids	Bark: Nontannin	Bark: Tannin	Bark: Purity of extractive	Wood: Insolubles in extractive	Wood: Soluble solids	Wood: Nontannin	Wood: Tannin	Wood: Purity of extractive
							Feet	*Years*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina:																			
649	553	New Jersey	Ocean	Whiting	Clump	Aug. 2, 1943	4	1	37.2	3.2	36.8	26.9	9.9	27	1.6	9.6	9.2	0.4	4
650	554		do	do	do	do	4	3	19.7	2.3	32.9	22.6	10.3	31	.9	7.3	6.7	.6	8
651	555		Atlantic	Smithville	do	do	6	6 and 8	18.2	2.5	35.8	21.3	14.5	41	.9	6.5	5.8	.7	11
652	558		Salem	Deepwater	do	do	3	1	36.7	3.0	42.7	29.0	13.7	32	1.2	10.0	9.7	.3	3
653	560		do	do	do	do	6	1	30.0	2.2	41.0	28.2	12.8	31	1.2	8.6	8.3	.3	3
654	561		do	do	do	do	6	2	18.4	2.2	37.0	22.9	14.1	38	1.1	6.9	6.5	.4	6
655	562		do	do	do	do	6	2	21.0	1.8	27.1	15.7	11.4	42	.9	5.2	4.8	.4	8
656	566		do	Cohansey	do	do	3	1	29.3	2.1	37.2	26.8	10.4	28	1.2	8.7	8.2	.5	6
657	567		do	do	do	do	3	2	15.8	2.1	39.1	25.0	14.1	36	.8	6.3	6.0	.3	5
658	570		Cumberland.	Mauricetown.	do	do	20	20 and 22	15.3	3.5	34.7	20.1	14.6	42	1.2	6.1	5.2	.9	15
658a [1]	----		do	do	do	do	20	20 and 22	----	1.6	24.0	12.6	11.4	48	----	----	----	----	----
658b [1]	----		do	do	do	do	20	20 and 22	----	2.5	39.6	24.4	15.2	38	----	----	----	----	----
659	584	Maryland	Charles	Wicomico	Single plant.	Aug. 22, 1937	6	Old	27.3	2.2	37.5	24.4	13.1	35	1.2	8.5	7.8	.7	8
660	580		do	do	do	July 28, 1937	9	Old	34.7	1.5	20.6	11.3	9.3	45	1.0	6.4	4.2	2.2	36
R. glabra:																			
661	592	Pennsylvania.	Montgomery.	Wyndmoor	Clump	July 16, 1943	6	1	45.3	3.2	41.6	33.5	8.1	19	1.0	14.4	13.5	.9	6
662	----	Maryland	Washington.	Hancock	Field	July 28, 1943	6	3 and 6	28.4	3.1	28.7	19.7	9.0	31	1.0	6.2	5.0	1.2	19
R. typhina:																			
663	628	New Jersey.	Salem	Deepwater	Clump	Aug. 2, 1943	8	1	39.3	1.6	35.8	30.4	5.4	15	1.0	8.9	8.3	.6	7
664	629	Pennsylvania.	Montgomery.	Wyndmoor	do	July 6, 1943	9	1	31.9	2.6	37.9	31.6	6.3	17	.8	8.2	7.3	.9	11
665	630		do	do	do	do	9	2	15.7	2.1	37.0	25.8	11.2	30	1.1	5.4	4.6	.8	15
666	631		do	do	do	do	9	3	11.2	2.0	36.0	21.9	14.1	39	1.1	5.2	4.5	.7	13
667	632		do	do	do	do	8	1	34.5	2.1	38.7	31.5	7.2	19	1.0	10.7	9.8	.9	8
668	633		do	do	do	do	8	2	17.0	2.0	36.2	24.4	11.8	33	.9	5.4	4.9	.5	9
669	634		do	do	do	do	8	3	12.7	2.3	34.1	22.9	11.2	33	1.0	4.8	4.0	.8	17
670	644	Maryland	Montgomery.	Potomac	Single plant.	July 11, 1938	11	1	32.8	2.0	36.9	28.3	8.6	23	.9	8.2	7.7	.5	6
671	645		do	do	do	do	11	Old	18.9	2.7	36.7	26.3	10.4	28	1.0	4.7	3.6	1.1	23

[1] Sample 658 was separated into outer bark (or ross) and inner bark. The outer bark, 658a, was 40.2 percent of the total bark; the inner bark, 658b, was 59.8 percent of the total bark.

TABLE 17.—*Source, description, and tannin analyses of flowers and seed clusters of 3 species of sumac* (Rhus)

Species and sample No.	Source: State	Source: County	Source: Locality	Source: Stand	Date collected	Description: Height of plant	Description: Sex	Description: Stage of development	Analyses (moisture-free basis): Insolubles in extractive	Soluble solids	Nontannin	Tannin	Purity of extractive
						Feet			*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina:													
672	New Jersey	Ocean	Whiting	Clump	Aug. 2, 1943	4	Male	Not yet in bloom; young heads 1½ to 4 inches long.	1.5	67.0	20.7	46.3	69
673	New Jersey	Salem	Alloway	do	do	7		In bloom; heads 3 to 7 inches long	1.6	57.4	22.3	35.1	61
674	New Jersey	Atlantic	Smithville	do	do	6	Female	Seed cluster more than 1 year old	.7	13.1	9.9	3.2	24
675	Maryland	Prince Georges	Beltsville	do	Aug. 15, 1941	4	Male	In bloom	1.2	52.9	19.2	33.7	64
676	Maryland	do	do	do	do	4	Female	Seed almost formed	.9	37.6	16.7	20.9	56
677	Maryland	Charles	Wicomico	Field	July 28, 1937			Not yet in bloom; young heads 1 to 2 inches long.	1.2	64.8	17.3	47.5	73
678	Maryland	do	do	Clump	Aug. 22, 1937	6	Female	Seed forming [1]	1.0	53.2	21.1	32.1	60
679	Maryland	do	do	do	do	4		Not yet in bloom [1]	.6	58.5	22.7	35.8	61
680	Virginia	Fairfax	Centreville	Single plant	Aug. 6, 1942	3	Female	Just blooming	1.6	53.5	18.1	35.4	66
681	Virginia	do	do	do	do	3	do	Seed almost formed		33.9	15.4	18.5	55
682	Virginia	Culpeper	Culpeper	do	do	4	Male	In bloom; yellow flowers [2]		52.2	25.7	26.5	51
683	Virginia	do	do	do	do	4	do	In bloom; green flowers [2]		49.6	19.1	30.5	61
684	Virginia	do	do	Clump	do	4	Female	In bloom	1.2	53.8	17.2	36.6	68
685	Virginia	Orange	Gordonsville	do	do	4	do	Seed almost formed	1.7	31.5	16.0	15.5	49
686	Virginia	Fluvanna	Carysbrook	Single plant	do		do	do	1.6	38.6	20.7	17.9	46
687	Virginia	Buckingham	Dillwyn	Clump	do	6	Male	Just blooming		50.0	28.8	21.2	42
688	Virginia	do	do	Single plant	do	8	Female	Seed beginning to form		44.4	17.9	26.5	60
689	Virginia	do	do	Clump	do	8	do	Seed formed	.8	43.8	17.5	26.3	60
690	Virginia	Prince Edward	Farmville	Single plant	do	6	Male	Just blooming	2.3	52.1	24.3	27.8	53
691	Virginia	Lunenburg	Lunenburg	do	do	20	do	do	2.0	55.0	20.6	34.4	63
692	Virginia	do	do	do	do	20	Female	White flower head		64.2	17.5	46.7	73
693	Virginia	Halifax	Halifax	do	do	10	Male	Just blooming		47.4	23.1	24.3	51
694	Virginia	do	do	do	do	5	do	do		49.1	19.0	30.1	61
695	Virginia	do	do	do	do	10	Female	Seed formed	1.7	23.2	13.3	9.9	43
696	Virginia	do	do	do	do	5	do	Seed not yet formed		27.4	17.5	9.9	36
697	Virginia	do	do	do	do	7	do	Seed formed		29.4	16.4	13.0	44
698	Virginia	do	do	do	do	7	do	In bloom		57.3	17.9	39.4	69

R. glabra:													
699	Pennsylvania.	Montgomery	Wyndmoor	Clump	July 6, 1943	3	Male	In bloom; flower heads 6 to 12 inches long.[1]	1.3	49.4	23.8	25.6	52
700		do	do	do	do	3	do	Not yet in bloom; heads 3 to 6 inches long.[1]	1.6	65.2	22.9	42.3	65
701		do	do	do	do	4	do	In full bloom; yellow spreading heads.[3]	1.4	47.0	26.5	20.5	44
702		do	do	do	July 13, 1943	4	do	Past full bloom; brown [3]	1.4	37.5	20.2	17.3	46
703		do	do	do	do	4	Female	Seed forming [3]	1.1	52.0	21.4	30.6	59
704		do	do	do	Aug. 16, 1943	4	do	Seed formed [3]	1.1	22.9	10.9	12.0	52
705		do	do	do	July 16, 1943	6	do	Seed forming [3]	1.5	53.2	24.0	29.2	55
706		do	do	do	Oct. 22, 1943	6	do	Seed formed [3]	.7	16.0	8.7	7.3	46
707		Huntingdon	Burnt Cabins	Field	July 6, 1943	4	Mostly male.	In bloom	1.3	48.8	20.6	28.2	58
708		Fulton	Waterfall	do	July 13, 1943	4	Female	Seed forming	1.5	53.6	20.6	33.0	62
709		do	Wells Tannery	Clump	do	10		In bloom	1.1	50.5	23.0	27.5	54
710		Bedford	Breezewood	do	July 15, 1943	6	Female	Seed forming	1.0	49.8	22.0	27.8	56
711		do	Everett	do	do	6	Male	Probably past full bloom	1.2	39.1	23.9	15.2	39
712	Maryland	Baltimore	Kingsville	Single plant.	Aug. 21, 1941		Female	Seed formed	3.3	24.5	16.3	8.2	33
713		Montgomery	Bethesda	Clump	Oct. 23, 1937		do	do	.6	18.0	7.8	10.2	57
714		Washington	Williamsport	do	July 28, 1943		do	Seed cluster 12 to 15 inches long	1.2	24.9	14.9	10.0	40
715		do	Indian Springs	Field	do	6	do	Seed cluster 4 to 8 inches long	1.3	21.5	11.9	9.6	45
716		do	Hancock	Clump	do	5	do	Small seed cluster	1.3	26.1	15.1	11.0	42
717		do	do	do	do	8	do	Large seed cluster	1.5	25.1	13.2	11.9	47
718		do	do	do	do		do	Long, slender seed cluster	1.4	23.6	13.5	10.1	43
R. typhina:													
719	Pennsylvania.	Montgomery	Wyndmoor	Field	July 6, 1943	12	do	Seed cluster 4 to 6 inches long; seed formed.[3]	1.3	23.3	13.2	10.1	43
720		do	do	do	Aug. 16, 1943	12	do	Seed cluster 4 to 6 inches long [3]	1.2	23.2	14.7	8.5	37
721		Fulton	Hustontown	do	July 6, 1943	5	do	Seed formed	1.6	26.8	13.6	13.2	49
722		Bedford	Breezewood	do	July 15, 1943	9	do	do	1.6	27.9	15.1	12.8	46
723		do	Everett	Clump	do	7	do	do	1.8	24.0	13.4	10.6	44
724	Maryland	Cecil	Elk Neck	do	Aug. 21, 1941		do	do	2.1	24.0	16.1	7.9	33
725		do	do	do	do		do	do	3.2	29.0	18.8	10.2	35

[1] Samples 678 and 679 were taken from the same clump on the same date but represent 2 stages in the development of the flower heads. The same is true for samples 699 and 700.

[2] Sample was moldy.

[3] Samples 701 and 702, 703 and 704, 705 and 706, and 719 and 720 represent 4 pairs. The 2 samples of each pair were collected from the same clump but on different dates.

TABLE 18.—*Source, description, and tannin analyses of leaves and leaflets of 3 species of sumac* (Rhus) *collected too late to be included in tables 13 and 14 or in the statistical calculations*

Species, leaf or leaflet, and sample No.	Source: State	Source: County	Source: Locality	Source: Stand	Date collected	Description[1]: Exposure to sunlight	Description[1]: Height of plant	Description[1]: Color of leaves when collected	Analyses (moisture-free basis): Insolubles in extractive	Analyses: Soluble solids	Analyses: Nontannin	Analyses: Tannin	Analyses: Purity of extractive
							Feet		*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
R. copallina:													
Leaves:													
726	New Jersey	Middlesex	South River	District	Aug. 24, 1947	Full	4	Green	2.3	48.6	21.6	27.0	56
727		do	do	Clump	do	do	5	do	2.5	46.3	22.2	24.1	52
728		Burlington	Medford Lakes	Field	Aug. 19, 1945	Restricted	5	do	1.1	41.7	22.6	19.1	46
729	Pennsylvania	Philadelphia	Philadelphia	do	Aug. 26, 1947	Full	3	do	3.3	47.2	23.5	23.7	50
730a	Virginia	Arlington	Arlington	Clone	July 5, 1944	do	6	do	1.1	50.2	23.2	27.0	54
730b		do	do	do	July 12, 1944	do	6	do	1.1	50.0	23.6	26.4	53
730c		do	do	do	July 19, 1944	do	6	do	2.1	49.9	24.3	25.6	51
730d		do	do	do	July 26, 1944	do	6	do	1.5	49.6	24.0	25.6	52
730e		do	do	do	Aug. 3, 1944	do	6	do	1.7	47.9	22.9	25.0	52
730f		do	do	do	Aug. 9, 1944	do	6	do	2.2	46.7	24.7	22.0	47
730g		do	do	do	Aug. 16, 1944	do	6	do	1.6	47.0	24.4	22.6	48
731	Indiana	Johnson	Nineveh	Clump	Sept. 20, 1946	Restricted	15	Turning	2.7	52.7	22.2	30.5	58
732		Brown	Peoga	do	do	Full	9	do	2.8	56.7	20.4	36.3	64
733		do	Nashville	Field	do	do	6	do	2.6	56.2	21.4	34.8	62
734	Florida	Alachua	Gainesville	do	July 23, 1946	Restricted	3	Green	1.7	43.1	19.3	23.8	55
Leaflets:													
735	New Jersey	Salem	Yorktown	do	Aug. 21, 1945	Full	5	do	1.3	47.7	21.8	25.9	54
736		do	Deepwater	do	Aug. 28, 1945	do	4	do	1.3	51.1	23.7	27.4	54
R. glabra:													
Leaves:													
737	Pennsylvania	Bucks	Southampton	do	Aug. 22, 1946	do	5	Turning	1.9	52.9	19.5	33.4	63
738		Montgomery	Wyndmoor	do	Aug. 31, 1944	Restricted	4	Green	1.9	41.0	24.7	16.3	40
739		do	do	do	Sept. 18, 1944	do	4	do	1.9	40.1	22.4	17.7	44
740		do	do	Clump	Aug. 6, 1945	Full	3	do	1.8	45.3	22.6	22.7	50
741	Virginia	Arlington	Arlington	do	Aug. 14, 1944	Restricted	4	do	1.4	43.6	23.3	20.3	46
742	Indiana	Shelby	Mount Auburn	do	July 11, 1940	Full	13	do	1.5	40.5	20.2	20.3	50
743		Johnson	Nineveh	do	Sept. 20, 1946	do	4	Turning	2.0	49.9	22.4	27.5	55
744		Brown	Nashville	do	do	Restricted	4	do	2.1	48.4	20.4	28.0	58
745	Kentucky	Morgan	Relief		Sept. 10, 1943				1.3	41.1	23.7	17.4	42

Leaflets:													
746	Pennsylvania	Montgomery	Wyndmoor	Field	Aug. 15, 1944	Full	4	Green	2.3	51.7	22.9	28.8	56
747		do	do	Clump	Aug. 21, 1944	do	3	do	1.5	51.2	23.1	28.1	55
748		do	do	Field	Aug. 24, 1944	Restricted	4	do	1.8	44.5	24.5	20.0	45
749		do	do	Clump	Aug. 7, 1945	Full	3	do	1.5	46.2	22.8	23.4	51
750		do	do	Field	Sept. 4, 1945	do	4	do	1.6	48.6	24.4	24.2	50
R. typhina:													
Leaves:													
751a		do	do	Clump	Aug. 31, 1944	do	9	do	1.7	41.9	22.7	19.2	46
751b		do	do	do	Sept. 18, 1944	do	9	do	1.5	38.4	20.7	17.4	45
751c		do	do	do	July 30, 1945	do	9	do	1.4	44.2	18.9	25.3	57
752		do	Oreland	District	Aug. 21, 1946	do	8	do	2.2	41.7	19.8	21.9	53
Leaflets:													
753		do	Glenside	Clump	July 14, 1944	do	5	do	1.2	53.2	22.5	30.7	58
754		do	Wyndmoor	do	July 22, 1944	do	9	do	1.5	41.9	26.4	15.5	37
755		do	do	do	do	Restricted	9	do	1.9	51.0	25.1	25.9	51
756		do	do	do	do	Full	9	do	1.6	55.2	25.7	29.5	53
757a		do	do	do	Aug. 15, 1944	do	9	do	1.8	49.1	22.9	26.2	53
757b		do	do	do	Aug. 21, 1944	do	9	do	1.6	46.4	23.0	23.4	50
757c		do	do	do	Aug. 14, 1945	do	9	do	1.9	50.4	21.4	29.0	58
758		do	do	do	Aug. 24, 1944	do	6	do	1.9	49.9	22.7	27.2	55
759		do	Oreland	do	Sept. 11, 1945	do	9	do	1.4	40.8	21.6	19.2	47

[1] All samples were in good condition.

Lists of Samples Used in Determining Various Associations

The following samples were used in determining the effect of sex (table 4).

Sex	*Sample No.*
Rhus copallina:	
Male	46, 47, 48, 49, 50, 51, 52, 61, 80, 83, 90, 91, 100, 105, 107, 109, 111.
Female	53, 54, 55, 56, 57, 58, 59, 60, 62, 82, 84, 88, 89, 101, 106, 108, 110, 112.
Rhus glabra:	
Male	205b, 205c, 235a, 235b, 235c, 239, 241, 272, 275, 323a, 323b, 323c, 323e, 323f, 323g, 323h, 323i, 323j, 323k, 323l, 329a, 329b, 329c, 330a, 335a, 337a, 337b, 338a, 338b, 339a, 339b, 340, 341, 342, 343, 344, 345.
Female	207a, 207b, 236a, 236b, 236c, 240, 242, 273, 276, 324a, 324b, 324c, 324d, 324f, 324g, 324h, 324i, 324j, 326a, 326b, 326c, 326e, 326f, 326g, 326h, 326i, 327c, 327d, 327e, 327f, 327g, 327h, 331a, 331d, 332a, 332b, 333a, 333b, 333c, 334a, 334b, 336a, 346, 347, 348, 350, 351, 353, 354.

The following samples were used in determining the effect of exposure to sunlight (table 5).

Location	*Sample No.*
Rhus copallina:	
1	46, 47, 49, 50, 51, 52 versus 48.
2	53, 54, 55, 56, 57, 58, 59 versus 60.
3	63h, 69a, 70 versus 66, 67, 68.
4	91 versus 90.
5	107 versus 105.
6	108 versus 106.
7	111 versus 109.
8	112 versus 110.
Rhus glabra:	
9	228 versus 227.
10	329a, 329c, 329g versus 330a, 330b, 330d.
11	333a, 333b versus 334a, 334b.
12	324a, 326a, 347 versus 336a, 346, 348.
13	341, 342, 323b, 329b versus 335a, 340.
14	337a, 338a versus 328a, 330c.
15	338b, 343, 344 versus 335b.
16	323g, 323h, 323i, 323j, 323k versus 328c, 328d, 328e, 328f, 328g.
17	332c versus 336b.

The following samples were used in determining the effect of height of the plant (fig. 14).

Regression line	*Sample No.*
Rhus copallina:	
1	46, 47, 49, 50, 51, 52.
2	53, 54, 56, 57, 58, 59.
3	80, 81.
4	88, 89.
Rhus glabra:	
5	236a, 236b, 236c, 237a, 237b, 237c, 238a, 238b, 238c.
6	243, 244, 245.
7	323a, 329a.
8	323c, 323d, 329c, 329d.
9	323b, 329b, 341, 342.
10	328a, 330c.
11	337a, 338a.
12	323e, 338b, 339a, 343, 344.
13	323f, 345.
14	323l, 337b, 339b.

Regression line	*Sample No.*
Rhus glabra—Continued	
15	324a, 326a, 333b, 347.
16	334b, 336a, 346, 348.
17	324c, 326b, 331a, 332a.
18	324d, 326c, 332b, 350, 351.
19	331b, 352.
20	333c, 353, 354.
21	327a, 331c.
22	324e, 324f, 324g, 324h, 324i, 324j, 326d, 326e, 326f, 326g, 326h, 325i, 327b, 327c, 327d, 327e, 327f, 327g.
23	327h, 331d.

The following samples were used in determining the effect of date of collection (fig. 15).

Regression line	*Sample No.*
Rhus copallina:	
1	24a, 24b.
2	30a, 30b.
3	31a, 31b.
4	32a, 32b.
5	35a, 35b.
6	63b, 63c, 63d, 63e, 63f, 63g, 63h, 63i, 63k, 63l, 63m, 63n, 63p.
7	65b, 65c.
8	69b, 69c.
9	71a, 71b.
10	71c, 71d.
11	72a, 72b.
12	72c, 72d.
13	74a, 74b.
14	74c, 74d.
15	75a, 75b.
16	75c, 75d.
17	79a, 79b.
18	79c, 79d.
19	85a, 85b.
20	85c, 85d.
21	87a, 87b.
22	87c, 87d.
23	94a, 94b.
24	94c, 94d.
25	97a, 97b.
26	97c, 97d.
27	98a, 98b.
28	98c, 98d.
29	99a, 99b.
30	99c, 99d.
Rhus glabra:	
1	196a, 196b.
2	208a, 208b.
3	209a, 209b.
4	235a, 235b, 235c.
5	236a, 236b, 236c.
6	237a, 237b, 237c.
7	238a, 238b, 238c.
8	264a, 264b.
9	264c, 264d.
10	267a, 267b.
11	267c, 267d.
12	268a, 268b.
13	268c, 268d.
14	269a, 269b.
15	269c, 269d.
16	270a. 270b.

Regression line	*Sample No.*
Rhus glabra—Continued	
17	271a, 271b.
18	271c, 271d.
19	274a, 274b.
20	274c, 274d.
21	277a, 277b.
22	277c, 277d.
23	278a, 278b.
24	278c, 278d.
25	279a, 279b.
26	279c, 279d.
27	280a, 280b.
28	280c, 280d.
29	281a, 281b.
30	281c, 281d.
31	323a, 323b.
32	323c, 323d, 323e, 323f.
33	323g, 323h, 323i, 323j, 323k.
34	324b, 324c, 324d.
35	324f, 324g, 324h, 324i, 324j.
36	325d, 325e, 325f, 325g, 325h.
37	326b, 326c.
38	326e, 326f, 326g, 326h, 326i.
39	327c, 327d, 327e, 327f, 327g.
40	328c, 328d, 328e, 328f, 328g.
41	329a, 329b.
42	329c, 329d, 327e.
43	330b, 330c.
44	330e, 330f.
45	331a, 331b, 331c.
46	332a, 332b.
47	333a, 333b.
48	334a, 334b.
49	338a, 338b.
Rhus typhina:	
1	410a, 410b.
2	426a, 426b.
3	438a, 438b.
4	438c, 438d.
5	439a, 439b.
6	439c, 439d.
7	442a, 442b.
8	442c, 442d.
9	444a, 444b.
10	444c, 444d.
11	445a, 445b.
12	445c, 445d.
13	446a, 446b.
14	446c, 446d.

The broken lines for *Rhus. glabra* in figure 15 are based on the following samples collected in spring: 205b, 206a, 207a, 324e, 325c, 326d, 327b, 328b; and the following samples collected in fall: 205c, 206b, 207b.